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ABSTRACT

A concept-based introduction to paratransit is provided in this instructional module for undergraduate and graduate transportation-related courses for disciplines such as engineering, business, marketing, and technology. The concept of paratransit generally refers to modes of transportation other than mass transit and solo-driven automobiles. The characteristics and applications of various paratransit modes are examined. A systematic approach for paratransit planning is presented along with problems and issues associated with the design and implementation of paratransit systems. Additional topics include: factors associated with rural transportation systems and the potential of designing paratransit for rural areas; the concept of market segmentation analysis; measures of existing service efficiency; how simple efficiency indicators are calculated; how needs and services are compared to determine areas of unmet needs; the process of system design; financing and marketing paratransit operations; management tasks associated with paratransit; and the use of brokerage in paratransit management. Case histories, examples, and an eight-page bibliography are included. (SW)

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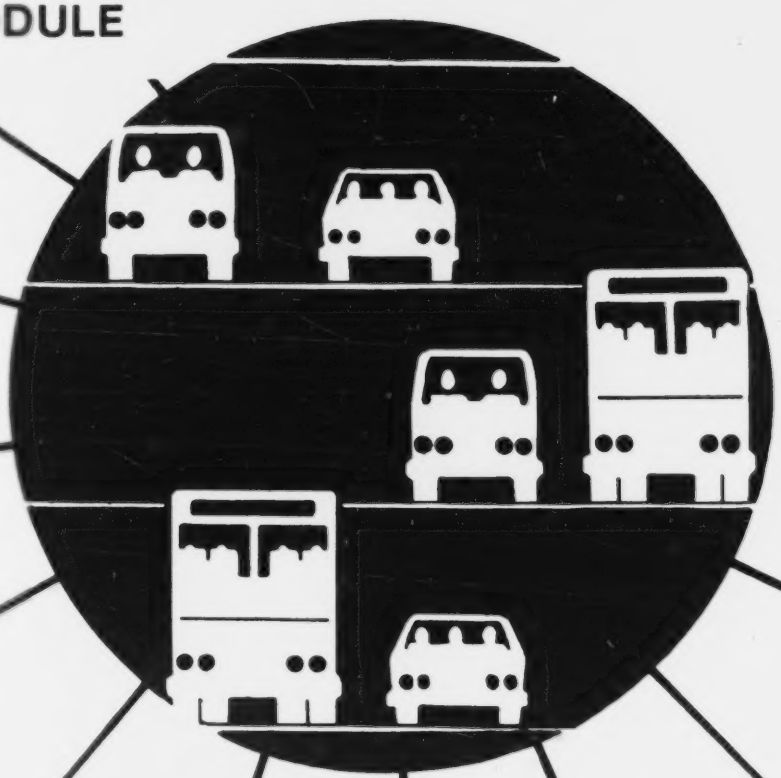
# PARATRANSIT

## INSTRUCTIONAL MODULE



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16. Abstract

This module is intended to provide a broad, concept-based introduction to the topic of paratransit for use in both undergraduate and graduate transportation-related courses. The material is designed to be useful in many disciplines including engineering, business, marketing, and technology.

The concept of paratransit generally refers to modes of transportation other than mass transit and solo-driven automobiles. This module examines the characteristics of various paratransit modes and the various applications of these modes according to their characteristics. A systematic approach for paratransit planning is presented along with problems and issues associated with the design and implementation of paratransit systems. Key ideas are illustrated by the use of case histories and examples where possible.

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# PARATRANSIT:

# AN INSTRUCTIONAL MODULE

Prepared by
The Transportation Education Project
Technology Education Program
West Virginia University

For
The Office of Service and
Management Demonstrations

Urban Mass Transportation
Administration

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December 1985

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Paratransit Module

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TABLE OF CONTENTS

PARATRANSIT MODULE


| | |
|---|---|
| Acknowledgements | ii |
| List of Figures | iii |
| List of Illustrations | iv |
| Professor's Introduction | v |
| General Introduction | x |
| Introduction to Paratransit | 1* |
| Transit and Paratransit Modes | 11* |
| Rural Transportation Systems | 24 |
| Student Review and Investigations | 30 |
| Guidelines for Student Review | 31 |
| Planning for Paratransit | 32* |
| Market Segmentation Analysis | 37 |
| Assessment of Existing Services | 46 |
| Analysis of Unmet Needs | 55 |
| Targeted Design and Implementation | 60* |
| Student Review and Investigation | 73 |
| Guidelines for Student Review | 75 |
| Financing Paratransit | 77 |
| Marketing Paratransit | 84 |
| Management of Paratransit | 92 |
| Overall Summary of Paratransit Module | 106 |
| Student Review and Investigation | 109 |
| Guidelines for Student Review | 110 |
| Selected References | 112 |


* An asterisk has been placed after the page numbers of module sections which we suggest concentrating on if you only have one class hour to treat this material.

LIST OF FIGURES


| | | |
|---|---|---|
| 1 | Planning for Paratransit | 34 |
| 2 | Market Segmentation Planning | 36 |
| 3 | Commuter Travel Survey | 41 |
| 4 | Sample Survey Results | 44 |
| 5 | Hypothetical Data on a Single Subscription Bus | 51 |
| 6 | Principal Groups Involved in the Transportation Decision-Making Process | 63 |
| 7 | Planning Process to Obtain Federal Funding | 66 |
| 8 | Hypothetical Data for Single DRT Van | 74 |
| 9 | Budget Breakdowns for Two Demonstration Vanpool Projects | 81 |
| 10 | Sample Ridesharing Promotional Brochure | 90 |
| 11 | Organizational Structures of Two Demonstration Vanpool Projects | 95 |
| 12 | Structure of the Westport Demonstration Plan | 101 |

LIST OF ILLUSTRATIONS


| | | |
|---|---|---|
| 1 | Applications of Paratransit | 6 |
| 2 | Communications Pattern for a Demand-Responsive System | 13 |
| 3 | Transit and Paratransit Modes | 19-23 |
| 4 | Utilization of Assessment Data | 47 |
| 5 | Principal Groups Involved in the Transportation Decision-Making Process | 62 |
| 6 | The Transportation Planning Cycle | 72 |

# PROFESSOR'S INTRODUCTION

## Project Purpose

Since the founding of the Service and Methods Demonstration Program (SMD) in 1974, the Urban Mass Transportation Administration (UMTA) has been intimately involved in the development and diffusion of innovations related to mass transportation. After a decade of experiments and demonstrations, valuable insights and techniques have emerged.

However, students graduating with transportation degrees are often unaware of much of the information which UMTA has developed. These modules were designed to introduce future transportation professionals and people with related interests to five areas where new ideas have proven important in the planning and management of public transportation systems. The topics are:

- Market Segmentation Planning;
- Paratransit;
- Transportation Brokerage;
- Rural Public Transportation; and
- Public Transportation Pricing.

The topics are defined at the end of this introduction and discussed in the General Introduction.

## Description of the Modules

These modules are intended to provide a broad, concept-based introduction to each of the five topics for use in both undergraduate and graduate transportation-related courses. The material is designed to be useful in many disciplines, including engineering, business, planning, marketing, public administration, and technology.

One of the major findings of our phone interview in February 1983 was that professors want curriculum packages to be flexible. These modules were designed to be taught for one to three classroom hours. The module text may be used in a number of ways including uses as:

- Lecture notes;
- Student homework readings;
- Overhead transparencies from illustrations; and
- In-class reading and discussion.

All graphic materials labeled as illustrations are designed to be used as overhead projections while graphic materials labeled figures are designed for photocopying.

Professors should feel free to use these materials to supplement regular course design and materials in any way they wish. However, we have placed asterisks in the Table of Contents after sections which we suggest you concentrate on if you only have one hour to teach the module topic. At

the end of each of the three sections of the module, there are Student Review Questions based on the preceding material.

The topics of the five modules have a significant content overlap which is reflected in the module texts themselves. Therefore, some module sections are virtually repeated from one module to another. Professors utilizing more than one of the modules should make allowances for this in planning their presentations.

Persons wishing more detailed and in-depth information on particular topics should refer to the list of references at the end of each module. Sources published by UMTA may be located through the UMTRIS computer database on the DIALOG system or from the National Technical Information Service (NTIS). It may also be possible to obtain recent UMTA Technical Reports and a current bibliography from U.S. DOT/TSC, Service Assessment Division (DTS-64), Kendall Square, Cambridge, MA 02142.

## Module Topic Definitions

### Market Segmentation

Market Segmentation is a transportation planning approach which involves identifying groups in a market that are "homogeneous with respect to important criteria that influence their travel choices" (Nelson, TRR 823, p. 8).

This approach is associated with integrated mobility-based transportation planning and allows the consideration of a variety of solutions to individual travel needs and markets.

Paratransit

Paratransit refers to modes of passenger transportation which are on a continuum between the private automobile and conventional transit. They are usually available to the general public and able to operate over the street and highway system (Kirby, 1974, pp. 1, 9). Paratransit generally refers to modes such as dial-a-ride, shared-ride taxi, jitneys, vanpools, and so on.

Transportation Brokerage

The transportation broker identifies the transportation needs and demands of various market segments and then matches these needs with available transportation resources. The broker also may resolve barriers to innovative transportation arrangements and implement those arrangements through contracts with social service agencies, employers and private operators. Brokerage is a concept which highlights many of the roles a transportation manager can undertake to provide mobility comprehensively and cost-effectively.

## Rural Public Transportation

Rural public transportation involves systems in rural and small urban areas with populations under 50,000 people. Public transportation services in rural areas have often been provided solely by social service agencies serving their clients. New federal programs have facilitated the development of rural systems open to the public but strong local involvement and creativity are needed to create and support such services.

## Public Transportation Pricing

Public transportation pricing systems are composed of fare structures and fare collection mechanisms. They are based on consideration of the system users, politics, funding sources, system costs, and system service characteristics. Planning pricing systems involves the balancing of many complex demands. Higher fares often lead to increased revenue generation but they can decrease ridership thereby lowering the social benefits of transit service. Complicated fare systems can promote equity among riders but they can make fares difficult to collect efficiently.

## GENERAL INTRODUCTION

Historically, mass transportation in the United States was almost always provided by private, profit-seeking enterprises. The public's interest was usually protected through regulation by a public utility commission. Such commissions controlled entry into the transit business, fares, and the types of service offered.

As the number of automobiles and the quality of roads increased, mass transit ridership suffered a major decline. At the end of World War II, 37% of commuters were riding to work on public transit. By 1979, this figure had fallen to 6%; and there was an automobile for every two Americans. An expanding economy permitted many urban residents to purchase cars and suburban houses.

Mass transportation did not adapt to these changes, and private enterprise gradually withdrew from providing such services. The federal government began to provide financial assistance for transit systems which permitted local governments to take control of them. In the 1960s, the federal government initiated operating subsidies to help curb deficits.

As federal assistance for transportation systems grew, it became evident that the government was spending

increasing sums of money to support transportation systems which were not adjusting to changing conditions. Research into alternative methods of providing public mobility was a necessity. In 1964 Congress created the Urban Mass Transportation Administration (UMTA) to "research, develop, and demonstrate projects in urban mass transportation."

In 1974 UMTA created the Service and Methods Demonstration (SMD) Program to promote the development and widespread adoption of innovative transit services and transportation management techniques. Some of the areas in which UMTA has facilitated major changes are bus and rail equipment design, automation, paratransit, brokerage, integrated planning, and other management innovations.

These modules were designed to introduce students of transportation to information on five topics: market segmentation planning, paratransit, transportation brokerage, rural public transportation, and public transportation pricing. The information in the modules is based on the results of numerous UMTA-funded demonstration and research projects related to these topics. The five topics are introduced on the following pages.

## New Directions

### Market Segmentation

Public transportation today involves a variety of transportation modes with varying costs and characteristics. A transportation planner must have new planning tools to cope with the complex array of possible systems.

Instead of focusing on transportation systems, the planner should begin by studying the actual mobility needs of the people to be served. Needs-based transportation planning is the only way to ensure services that are fully used and cost-effective. New or modified services which meet the needs of certain groups must then be marketed to inform people of the service's benefits for them.

There are four basic steps to the Market Segmentation planning approach:

1. Market Segmentation Analysis
2. Assessment of Existing Services
3. Analysis of Unmet Needs
4. Targeted Design

### Paratransit

Paratransit refers to any public transportation mode which falls on the continuum between the large fixed-route systems (bus, train, etc.) and the private automobile. This includes demand-responsive modes such as Dial-A-Ride and ridesharing modes such as vanpools. Paratransit

systems are designed to be flexible, cost-effective,and targeted to specific needs, but they cannot move large numbers of people on a single route as cheaply as mass transit systems.

Paratransit is being used to serve commuters, the handicaped, the elderly, and others. It works well in low-density or special needs situations where conventional mass transit would be too expensive. Paratransit also can work well as a feeder service for a conventional system.

Brokerage

Suppose a city decides to provide its elderly with a partially subsidized door-to-door service. It would be very expensive to buy cars, maintain them, hire drivers, and so on. It is cheaper to contract with local taxi companies who already have facilities and a workforce. The taxi company provides the service, the elderly give the drivers tickets (provided by the broker) good for part of each fare, and the city buys the tickets back from the taxi company.

In such a case, the transportation planner acts as a broker who matches transportation needs with available services. Rather than operating as a carrier, the transportation broker is primarily concerned with increasing people's mobility with equitable and cost-effective services.

Brokerage is useful in many areas of transportation management, particularly in the provision of flexible, low-cost paratransit services. The concept of brokerage highlights the new types of roles transportation managers can undertake in today's complex operating environments.

Rural Public Transportation

Rural areas are characterized by sparse populations, often difficult road conditions, and limited resources, yet people in rural areas need mobility for access to jobs, shopping and health care. Most rural people either own autos or rely on informal networks based on them. Public transportation in rural areas has usually been provided solely by social service agencies serving their clients. Federal funding has facilitated the development of systems open to the public but strong local involvement and creativity are needed to create and support such services.

Rural systems have employed many innovations including all types of cooperative arrangements, extensive use of volunteers, and experiments with non-traditional vehicles such as school buses and postal vehicles. Rural public transportation fills pressing needs but due to the difficulties of arranging and financing it, strong local support and creativity are essential.

## Public Transportation Pricing

Public transportation pricing systems are composed of fare structures and fare collection mechanisms. Fare structures deal with how much system riders pay to use the service while collection mechanisms range from simple cash fares to complex postpayment and user-subsidy ticket systems.

Planning the pricing of a public transportation service is an integral part of planning the overall transportation system. Fares and collection methods are based on factors such as who the system users are, political considerations, sources of funding, costs of the system, and system service characteristics. Planning pricing systems involves the balancing of many complex demands.

Higher fares often lead to increased revenue generation but they can decrease ridership thereby lowering the social benefits of transit service. Complicated fare systems can promote equity among riders by permitting, for example, discounts for the elderly. However, too many complications can make fares difficult for bus drivers to collect efficiently.

# INTRODUCTION TO PARATRANSIT

The purposes of this section are:

- To familiarize students with the concept of paratransit and the role it plays in providing alternative means of transportation
- To describe the primary characteristics of paratransit modes.

## What is Paratransit

Paratransit is an approach to transportation which utilizes a variety of vehicles other than the solo-driven private automobile and fixed route public systems. Paratransit operations generally focus on specific purpose trips, such as commuting to and from work, and are designed to meet individual travel needs, such as door-to-door service for elderly and handicapped.

The purpose of paratransit services is to provide increased mobility for people who represent specific needs or markets through the provision of targeted, flexible, and cost-effective services.

## Characteristics of Paratransit Operations

The list below defines the basic characteristics of a paratransit system in operation. Following this list, each characteristic is discussed in more detail.

- It utilizes vehicles on a continuum between the solo driver's private auto and conventional fixed-route means.
- It travels over existing highways and streets.
- It is flexible and distinct from conventional transit.
- It serves "trip demand."
- It can be managed and operated by public or private interests.

> Paratransit is a System of Transportation Utilizing Vehicles on a Continuum Between the Solo-Driven Private Auto and Conventional Fixed-Route Systems.

Paratransit has always existed within transportation networks; taxi service is the most obvious modern example. The function of taxi service is to carry people either to an exact destination or to a fixed system pick-up place from which they can be carried to their destination. Similarly, taxis on call at a train terminal carry people from fixed system stations to exact destinations.

Within the last decade, the "personalized service" and "responsiveness to demand" elements or paratransit have been recognized for potential beyond these traditional roles. With some modifications, cars and vans can be made to serve the transportation handicapped, whose needs to travel on a daily basis are no less than those of the non-handicapped, but which often cannot be met by conventional systems. Even modification to conventional systems (i.e., bus ramps and lifts) do not help those who are unable to get to a bus stop because of prohibitive geography, long distances from fixed route stops, or severe handicaps.

In addition to meeting specific needs with a variety of modes, paratransit operations have been recognized to contribute to the reduction of traffic congestion, gasoline consumption, auto pollution, and the need to meet transportation demands with only two options: more large public systems and more roads.

The need for paratransit services in America was formalized by the adoption of a federal mandate in the mid-1970s, which directed all major urban transit planners to assess and formulate ridesharing and other low cost strategies for their respective cities and regions. Transportation System Management (TSM) is the name given to this federal mandate. TSM set up funds for the establishment of ridesharing and other paratransit services to meet local needs with cost-effective, flexible options.

## Paratransit Travels Over Existing Highways and Streets

The construction of new roads requires large outlays of capital and irreversible land use with no guarantee that transportation conditions will improve. With all the road building of the past twenty years, it is estimated that fifty percent of America's highways are overused ninety percent of the time.

The era of massive road construction has ended. This leaves transit planners with the job of making more efficient use of the resources that exist. The potential of a paratransit opertion to reduce the number of vehicles using existing roads makes it a important means for helping to manage areas of congested traffic flow.

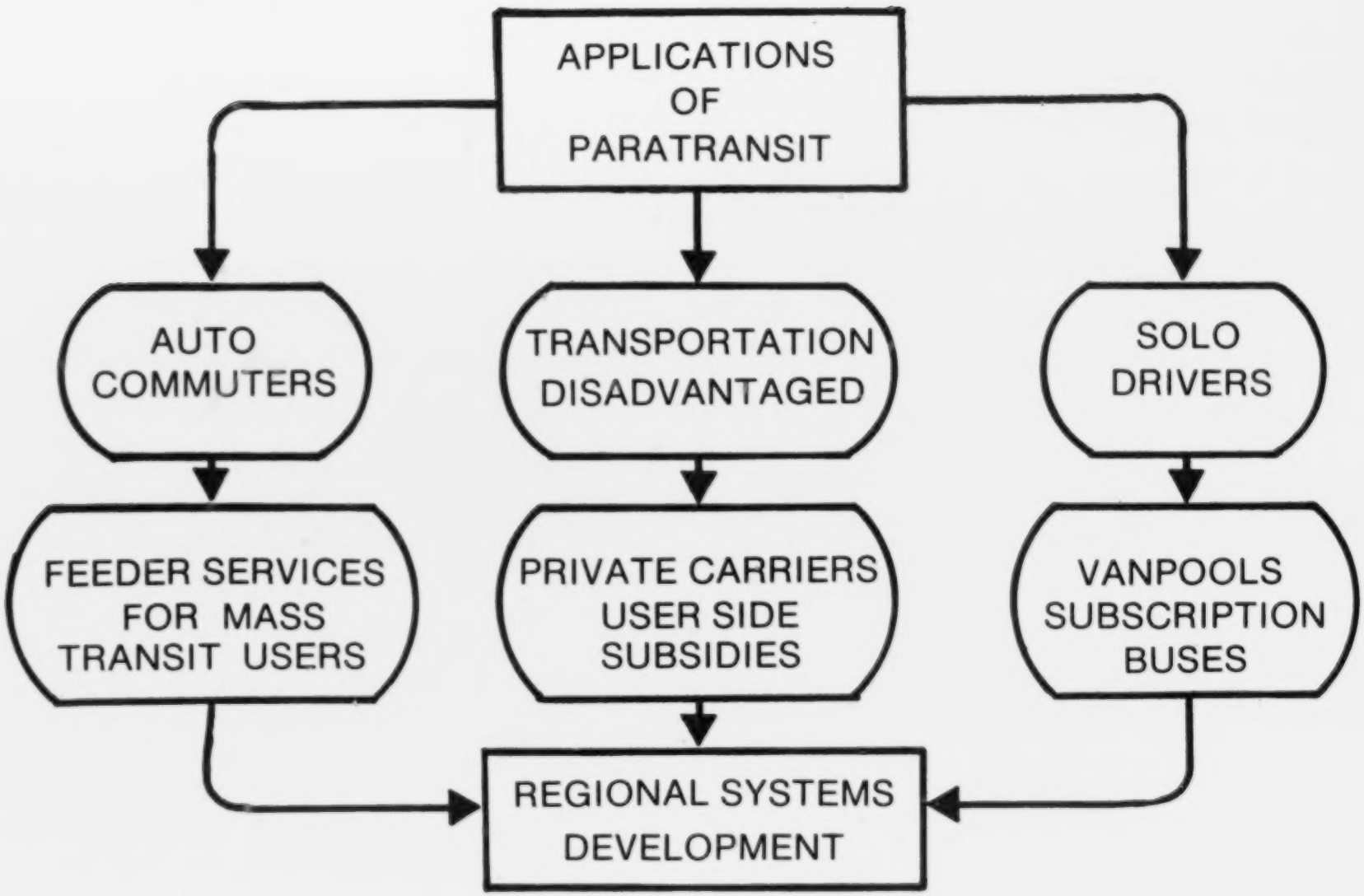
## Paratransit is Flexible and Distinct from Conventional Transit

By redefining "conventional transit" as fixed route bus and rail systems, paratransit operations can be viewed as those in which vehicles move more freely to and from diverse locations at varied times. This is an important distinction because it provides a means by which people in such locations can be linked, when needed, to existing conventional systems as well as to exact destinations. Paratransit can also provide a direct and personalized service to non-drivers and to those who do not own cars. Some specific applications of paratransit are shown in Illustration 1.

## Paratransit Serves Trip Demand

Another unique and useful characteristic of paratransit is that it can respond immediately and in a variety of ways to surges and drops in demand. These can be met by increasing or decreasing the number of vehicles and/or by varying the vehicles according to their individual carrying capacities.

Illustration 1. Applications of Paratransit.



## Paratransit Can Be Operated By Public or Private Agencies

The field of paratransit operation has opened new opportunities for both the public and private sectors. Taxi companies, as such, have always been engaged in private carrier paratransit. Now, however, they are being contracted through local government offices to serve special-needs portions of local populations, particularly the elderly and the handicapped.

Private taxi and van operators have the facilities, the versatile investment base, and the management expertise to efficiently implement such specialized demand-responsive services. Federal and state user-side travel subsidies also help to provide the means for elderly and handicapped people to meet their unique travel needs. These subsidies are based on discounted scrip which can be used for private demand-responsive systems.

In addition to providing direct services, both public and private agencies are now engaged in coordination of ridesharing systems. Under the TSM directive, local governments must attempt to reduce the number of cars that use commuter routes each day, particularly during peak hours. Part of the solution to such reductions is the encouragement and organization of ridesharing programs:

carpools, vanpools, subscription buses, etc. The implementation of the these programs can be handled by local government agencies or contracted out to private consulting groups.

History of Paratransit

Paratransit is the oldest form of transportation and it still represents the dominant transportation means for a majority of the people in the world. When the villagers in Zaire ride the produce truck from the market to the city they consider it a paid-for ride but we would classify it as a form of paratransit. Similarly, the small pickup trucks outfitted with benches to serve as minibuses in Kenya are technically jitneys, a form of paratransit.

The rediscovery of paratransit options in the United States dates from the efforts of UMTA in the 1970s to investigate and demonstrate cost-effective means of meeting specific public transportation needs which could not be met solely by providing larger fixed-route systems due to economic, logistic, and political reasons.

UMTA's early demonstrations included the promotion of and implementation of vanpools, the establishment of dial-a-ride services for the elderly and handicapped, and the integration of specialized agency transportation services. Not all demonstrations succeeded and many are no

longer in service. However, the demonstrations also provided knowledge about successful services and critical factors in their design and implementation. The results also showed that paratransit represents an exciting group of options which can and should be considered by all who provide public transportation services.

The early 1980s have seen a flowering of paratransit operations. It is hard to find a major city without car and vanpool promotions, and the use of coordinated demand-responsive services to meet specific needs is widespread. Paratransit operations currently utilize a variety of modes, primarily ridesharing, vanpooling, demand-responsive, and jitney. These will be discussed in the next section. These modal options employ many types of vehicles including cars, vans, taxis, minibuses, and buses.

Transportation Brokerage

Transportation brokerage is another innovation in public transportaion management. Brokers serve as specialists in "people mobility" and operate in the free market to facilitate the matching of needs and services in a locale. Rather than operating as a carrier, the transportation broker is primarily concerned with arranging for the provision of services targeted to specific needs.

Suppose a city decides to provide its elderly with a partially subsidized door-to-door service. It would be very expensive to buy cars, buy and operate maintenance facilities, hire drivers, and so on. Yet local taxi companies have already invested the capital in developing these functions. It is cheaper and more rational for the city to contract with local taxi operators to provide the service. The taxi company provides individual trips, the elderly give the drivers tickets (provided by the broker) for part of the cost of each trip, and the city buys the tickets back from the taxi company.

In this case the transportation planner is acting as a broker. Similarly, brokers can visit large local employers and promote the formation of employer-sponsored vanpools. In this way a valuable transportation service can be provided to commuters with little cost to the transit agency. The employer gains lower parking costs and improved regularity of worker arrivals.

## Summary

Paratransit is an exciting concept. Its uses can recombine existing resources in creative ways to meet mobility, environmental, fiscal, and social requirements. Because it is directed toward specific services, planning for paratransit provides new insights into the mobility needs and markets of local people. Increasing experience with paratransit should help in meeting those needs.

# TRANSIT AND PARATRANSIT MODES

The purposes of this section are:

- To differentiate between demand-responsive and fixed-route transit systems.
- To describe the characteristics of the various modes used in providing these two types of service.

There are four primary modal types which exist as options for transportation planners. They are: 1) demand-responsive, 2) fixed-route, 3) jitney, and 4) ridesharing. This section will describe the basic characteristics of each. It will also discuss some unique advantages and applications of each of these modal types.

The remainder of the module will refer to these modes and their relationships with each other and with the overall transportation network of cities and regions.

## Demand-Responsive Transportation Service

Demand-responsive transportation services (DRT) are tailored to meet individual service needs and generally

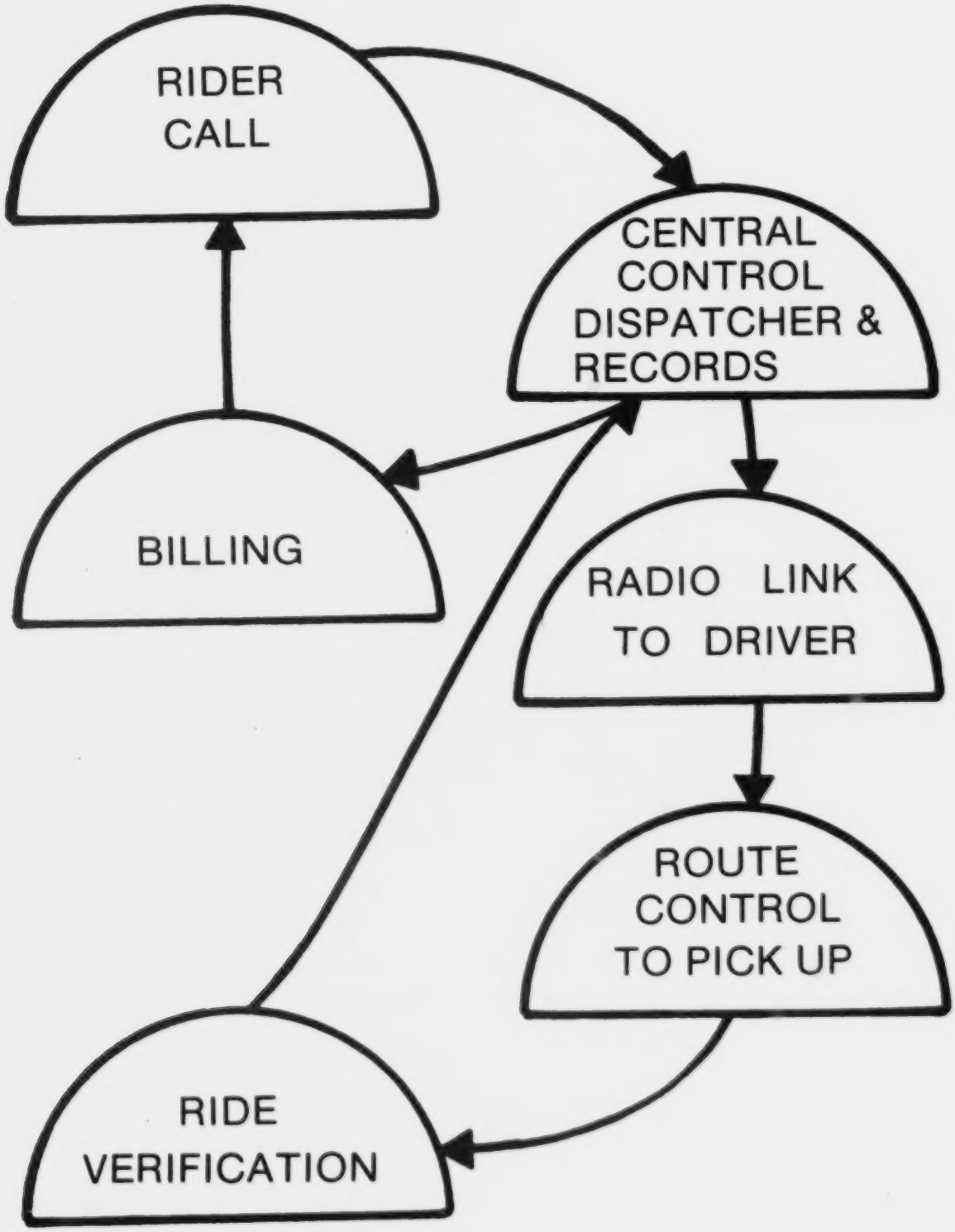
provide door-to-door service. Included in this category are taxi services (both single passenger and shared-ride service) and dial-a-ride systems. Illustration 2 shows the complex communication patterns of DRT systems.

DRT systems generally provide service between any origin and destination point but can also connect any point of origin to designated destinations, such as shopping centers or universities. Similarly, a DRT system can serve as a feeder service to another transportation system, such as bus or rail service.

DRT services generally are requested by telephone; are provided in small vehicles, such as cars, station wagons, vans, and small buses; and are often provided on a shared ride basis. Rides are provided either immediately upon request or by advance reservation. Because of their schedule flexibility and door-to-door service, DRT systems are well suited to meet the mobility needs of handicapped and elderly people, and those without access to a car. Because of their flexibility and individualized nature, DRT systems are also attractive to car drivers who are looking for an alternative.

For example, a DRT feeder service, which connects with a bus system, can effectively serve the commuting needs of people who live in outlying suburbs and work in a central business district (CBD). Both the Tidewater Regional Transit Authority in Norfolk, Virginia, and Peninsula

Illustration 2. Communication Pattern for Demand-Responsive System.



Transportation District Commission serving Hampton-Newport News, Virginia, provide such feeder service through contracts with private taxi operators.

DRT service is commonly provided by private operators such as taxi companies. However, publicly-operated DRT services, known as dial-a-ride systems, now operate in some communities to meet general and/or special transportation needs. However, privately operated systems seem to be replacing these. Agencies sponsoring DRT systems include city and county governments, regional transit authorities, and social service and health care agencies.

- DRT services are particularly suited to low-density areas where bus service is uneconomical.
- They are a cost-efficient means of transportation for short trips, and for off-peak service hours where demand for travel is lighter and more diffuse.
- They can effectively substitute for fixed-route, fixed-schedule bus service in the evenings and on weekends. When used as a feeder system, DRT services effectively complement bus service.
- Small service areas--6 square miles or less--often are served most practically by DRT systems.
- DRT services provide a way to make public transportation services available 24 hours a day, 7 days a week.

Fixed-Route Service

This category is comprised of conventional fixed-route, fixed-schedule bus and rail services. In contrast to the flexible, individualized nature of DRT services, fixed-route services are designed to provide the same service to all people for all types of trips. It is the most common form of public transit service, and is best suited for carrying large volumes of people along densely-developed corridors. A strong central business district or other primary center of activity--such as a university, centralized shopping, commercial, industrial, or health care center--is an essential focus for this type of service.

The prime advantage of traditional bus service is its capability to carry more people at a lower cost per trip; however, generating a sufficiently high volume of ridership can be a critical problem. The two groups who most commonly use this service are commuters and transit-dependent people - those without access to a car when they need or wish to travel. Since the service is not door-to-door, it is not the most effective way to meet the mobility needs of many of the physically disabled or of many of the elderly.

Jitney Service

Jitneys are small capacity vehicles--mini-buses, vans, station wagons--that operate on a variable schedule along fixed routes. They stop either at designated loctions along a route or at any point when hailed. Although jitneys travel along a fixed route, they can deviate in order to bring passengers closer to their destinations.

Jitneys were a popular form of public transportation in the USA in the early 1900s, but by the mid-1920s had been banned in most cities because of their competition with trolley car service. They are still a fixture in developing countries even in places like Bangkok, Thailand where they compete directly with public bus services. They are, however, re-emerging in Atlantic City, New Jersey; San Francisco, Anaheim, and San Diego, California, Indianapolis, Indiana; Pittsburgh, Pennsylvania; Chicago, Illinois; Chattanooga, Tennessee; and Miami, Florida. Jitneys also hold promise for use in small cities.

Jitney operators are generally individual entrepreneurs or taxi operators. Because they operate small vehicles and can deviate off a route, the service they offer is often faster, more convenient, and more attractive then that of a large capacity bus. Also, because of their size and more flexible mode of operation, jitneys can often operate at a profit on low ridership routes where bus service is uneconomical. In addition, they can substitute

for or complement bus service in low-density areas or during low-demand, off-peak periods in higher density areas. Since jitneys can offer a variety of services at low fares--usually as low as bus fares--they could provide affordable services for many groups, including low-income individuals.

Ridesharing

Carpools, vanpools, and subscription bus operations represent various forms of ridesharing arrangements, which primarily are formed for commuter rush hour trips. They can be adapted, however, to meet the travel needs of the elderly and physically handicapped, or to provide access to jobs in suburban areas for low-income, inner-city residents. Ridesharing and pooling arrangements are an important element in paratransit planning as they represent low-cost, quick-result actions which go a long way in meeting commuter travel needs while reducing the number of single passenger cars on the main travel corridors.

The ridesharing concept is simple: people with similar origins and destinations agree in advance to ride together on a regular basis. The service is tailored to meet the specific needs of each group. Members of a pool agree upon the schedule, route, amount and method of payment, origins and destinations, who will drive, and what

vehicle will be used. The advantages of a pool over conventional bus service include door-to-door service, faster and more direct service, few stops, and an assured seat.

Ridesharing has grown increasingly attractive to more and more commuters in the last several years as the costs of cars, gasoline, maintenance, and insurance have sky-rocketed. Many pools are formed at the initiative of individuals who live in the same neighborhood and work in the same office, building, or general area. Increasingly, however, employers, private community groups, regional transit authorities, and government agencies are sponsoring ridesharing programs. In addition to employers and local agencies acting as the third party, transportation brokers can also serve to facilitate pooling operations.

A graphic summary of transit and paratransit modes is included as Illustrations 3a, 3b, 3c, 3d, and 3e.

Summary

The four major transit and paratransit modes are demand-responsive, ridesharing, fixed-route/fixed schedule, and jitneys. Each had unique uses, characteristics, and advantages. The transportation professional must utilize modal options in the most effective combinations to meet local travel needs and markets.

Illustration 3a. Transit and Paratransit Modes.

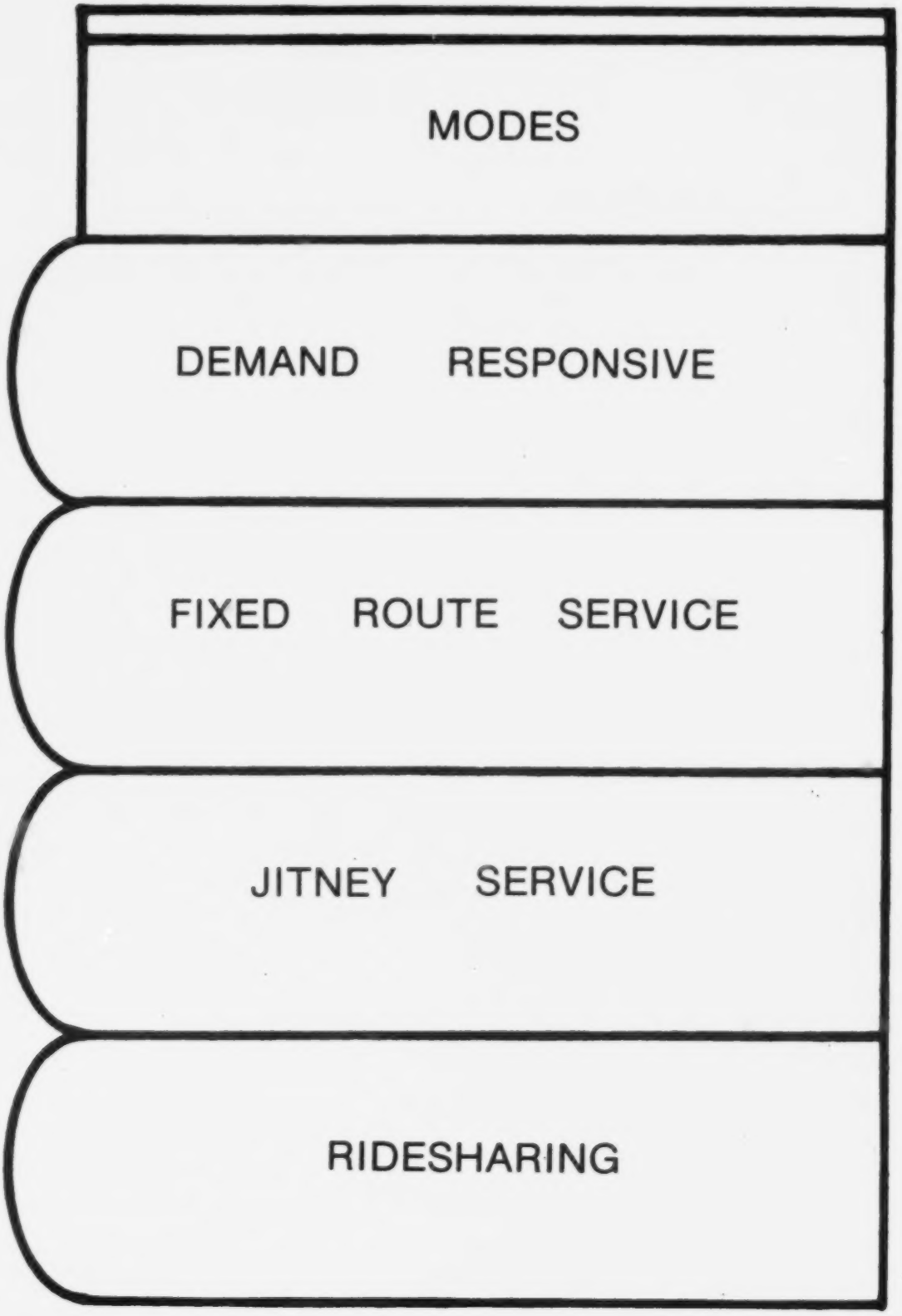


Illustration 3b. Transit and Paratransit Modes (cont'd).

| MODE | CHARACTERISTICS | EXAMPLES |
|---|---|---|
| DEMAND RESPONSIVE | MEETS INDIVIDUAL SERVICE NEEDS | TAXI SERVICE |
| | DOOR TO DOOR SERVICE | DIAL-A-RIDE |
| | SERVICE TO ELDERLY & HANDICAPPED | SPECIAL PURPOSE VANS |

Illustration 3c. Transit and Paratransit Modes (cont'd).

| MODE | CHARACTERISTICS | EXAMPLES |
|---|---|---|
| FIXED ROUTE SERVICE | MOVES LARGE VOLUMES OF PEOPLE | BUSES |
| | | LIGHT RAIL |
| | FIXED ROUTE & SCHEDULE | HEAVY RAIL |

Illustration 3d. Transit and Paratransit Modes (cont'd).

| MODE | CHARACTERISTICS | EXAMPLES |
|---|---|---|
| JITNEY SERVICE | VARIABLE SCHEDULE<br>FIXED ROUTES<br>PERSONAL STOPS ALONG ROUTE | MINI BUSES<br>STATION WAGONS<br>VANS |

Illustration 3e. Transit and Paratransit Modes (cont'd).

| MODE | CHARACTERISTICS | EXAMPLES |
|---|---|---|
| RIDESHARING | COMMUTER ORIENTATION<br>LOW COST/QUICK RESULTS<br>THIRD PARTY SPONSORS | CARPOOLS<br>VANPOOLS<br>SUBSCRIPTION BUS |

# RURAL TRANSPORTATION SYSTEMS

The purposes of this section are:

- To describe the factors uniquely associated with rural transportation systems.
- To illustrate the potential of designing paratransit for rural areas.

The feasibility of a transit system is primarily dependent on its ridership and efficiency of operation. Because of low population densities, often rough terrain, and high mileage-per-trip ratios in rural areas, the feasibility of rural transit systems often problematic.

The incentives which attract riders who own cars to use buses in large urban areas generally are not operative in small urban communities. Traffic congestion, parking availability and cost are usually not critical problems in small communities. Unless a bus system offers extensive routes, frequent scheduling, and minimal needs for transfers, a trip can usually be made more quickly and easily in a car, if one is available. These factors make regular bus service difficult and expensive to sustain in rural areas and small towns.

However, major needs for public transportation services in rural areas do exist. It is estimated that the rural population comprises 25% of the nation's total, and that it accounts for 40% of the total person-miles travelled. Auto travel is virtually the only means by which people living in rural areas can reach places of employment, shopping centers, and medical services. Increases in fuel, auto, and road maintenance costs have placed an especially heavy burden on rural populations since federal and state assistance is generally directed toward more heavily populated regions.

Furthermore, approximately half of the rural elderly do not own automobiles. This group is conspicuously dependent on outside help for their transportation needs. These needs are generally met by friends and relatives. The lack of ability to come and go when needed can be a troublesome condition to to elderly. A similar situation exists for handicapped people and non-drivers in rural areas. Both of these groups find it especially difficult to obtain regular and dependable transportation to places of employment as well as to shopping and medical centers.

Where do Solutions Lie?

In urban areas a variety of transit operations - public, private and specialized services - generally exist. Because of sufficiently high population densities and short trip distances, such services can operate economically. Rural areas, however, are often served by only a single taxi company or even a single taxi. The cost to individuals, particularly the elderly, of having a private taxi drive many miles each time a travel need arises is restrictive. What, then, is the answer?

Little historical information exists on solutions to rural transportation problems. As late as 1978, less than 1% of all federal transportation research went into rural projects, yet the rural population makes up one-quarter of the nation. The lack of existing public services in non-urban areas limits the availability of data. Since 1978, however, a number of rural studies and demonstrations have been conducted. They have concluded that needs and markets for public transportation services do exist in rural areas.

Demonstrations have shown that successful and cost-effective rural transportation systems can be designed and implemented. Most are formed initially by local people to meet specific needs and they depend heavily on strong local volunteer effort, community support, and local fundraising. Many of these originally small projects have grown as a

result of federal support and have expanded to nearby areas where services are needed. The following case study summary illustrates the potential for rural systems in overcoming the obvious problems discussed above.

The Stagecoach project of Bethel, Vermont, was iniated in 1976 by a non-profit community organization called Faith, Hope, and Charity, Inc. The system serviced an area of 800 square miles with a target population of 22,000. The population density was 28 people per square mile. Some of the major initial barriers to this system were severe cash flow problems, high insurance rates, and uncertain sources of funds.

It began as a one-vehicle fixed-route operation. The system has since expanded to 8 vehicles, providing six different types of service:

- fixed-route/fixed-schedule;
- demand-responsive through contracts with social service agencies;
- school charter and handicapped services;
- charter service for local groups;
- commuter subscription service; and
- freight delivery.

Ridership in 1982 was over 140 per day; the annual per capita ridership of people in the service area was approximately 1.6. Stagecoach has grown quite rapidly,

with recent expansion aided by receipt of a DOT Section 18 grant. With the expansion this system which had originated as a small agency-based service grew into its own regional transportation provider. The expansion, however, was only possible with an increase in local volunteer dispatchers and wider community participation.

Section 18, created through the Surface Transportation Act of 1978, apportions funds to the states on a formula basis. Each state is responsible for "fair and equitable" disbursement of funds, and up to 15% of its share can be reserved for administrative purposes and for providing technical assistance. Under the terms of the legislation, the Department of Transportation will pay up to 80% of the cost of capital and administrative expenses for the individual projects, and up to 50% of operating costs not covered by farebox revenue.

Through funding from Section 18, the Stagecoach Project was able to expand, and, thus realize increased ridership. However, federal support is not unlimited and may decline in future years. Jim Bautz of UMTA and others believe that future systems must emphasize the efficient utilization of resources, self help, public/private partnerships, and a more market-oriented delivery of public services.

Some directions which may assist rural transportation to meet these challenges include:

- increasing coordination among existing providers where possible;
- increasing the use of existing resources for multiple purposes such as postal buses and school buses for public transportation purposes.
- increasing the use of volunteers for driving and dispatching; and
- creating more information sharing networks among existing transportation providers.

Significant progress has been made since 1978 in meeting rural transportation needs. Much has been learned in areas where local officials, business people, transportation providers, and local citizens have addressed the issues collectively. However, no one has yet claimed an "answer" to the difficult problems involved in meeting rural transportation needs.

Summary

The problems associated with designing systems in rural areas are caused by low population densities, high mileage trips, and scattered activity centers. The lack of public transportation in rural areas is particularly troublesome to elderly and handicapped persons. The potential for designing workable systems may lie in area-wide cooperation, volunteerism, and dedicated hard work.

## STUDENT REVIEW AND INVESTIGATION

1. Discuss the concept of paratransit and how it differs from fixed-route transit.

2. Describe the transit and paratransit modes; compare their operational characterisitcs.

3. Describe how, or if, each of the four major transit and paratransit modes are used in your local area; and discuss possible new uses for each.

4. What are the common problems associated with public transit in rural areas, and how might such problems be compensated for?

5. Visit a paratransit service or an agency sponsoring one and ask the Director about the needs the service meets and how it is paid for. Also discuss the history and possible future of the service. Report to the class.

## GUIDELINES FOR STUDENT REVIEW

1. Paratransit typically

   a. Meets needs of individuals

   b. Travels from diverse locations to diverse destinations

   c. Usually operates on demand

   d. Carries individuals or small groups of people

   e. Carries fewer people at higher cost per passenger mile

   f. Uses a variety of small vehicles along all roads

   g. Can be operated by private carriers.

   Fixed-Route typically

   a. Meets needs of the general public

   b. Travels from fixed loctions to fixed destinations

   c. Operates on fixed schedules

   d. Carries large volumes of people

   e. Carries more people at lower cost per passenger mile

   f. Uses large vehicles along restricted corridors

   g. Typically run by public agencies

2. See Illustration 3.

3. This question is open ended.

4. Problems include: 1) long distances; 2) small ridership; 3) scattered population; and 4) distance between activity centers. There is no simple answer to compensate for these problems. Generally, successful services have been diversified--meeting a variety of needs, community organized, and often aided by volunteers.

# PLANNING FOR PARATRANSIT

The purpose of the following section are:

- To introduce students to a basic methodology for planning and designing paratransit systems.
- To provide students with the basic concepts and terminology of planning and design.
- To acquaint students with some of the issues which face transportation planners.

The methodology for planning and designing paratransit presented in this module has been developed from an analysis of federally funded demonstration projects which took place during the 1970s and early 1980s. Perhaps the most significant finding of these demonstrations has been that the success of a paratransit operation depends on how efficiently it meets the individual needs and preferences of potential users. This is especially significant to transportation planners because it requires that they study the people and the transportation infrastructures of their cities or regions. This process is required in order to

gain the data by which new systems or modifications of existing ones can be designed, implemented, and evaluated. The importance of local cultural, geographical, and political influences cannot be overstated.

Unless a system meets certain efficiency and quality standards, it will fail to gain ridership, and simply become another public deficit producer which does little to enhance mobility. Designing a paratransit system, and to a great extent any transit system, should therefore begin with answering these basic questions:

- Who desires and needs service?
- What criteria most influence travel choices?
- What services are desired or needed?
- What means already exist which can be utilized?
- How can new services be implemented?

(See Figure 1.)

A Methodology for Planning Paratransit

The planning process can be broken down into four steps, each of which addresses the questions suggested in the previous paragraph. The steps are: 1) market segmentation analysis, 2) assessment of existing services, 3) analysis of unmet needs, and 4) targeted design. It must be stressed that since the basis of all decisions lies in the context of local environments, the planner must first have a firm understanding of local issues, institutions, and

Figure 1. Planning for Paratransit

34

people. The illustration that follows outlines the four steps, their relative positions in the overall process, and the primary objectives and activities of each. (See Figure 2.)

Figure 2. **Market Segmentation Planning.**

| | Objectives: | Activities: |
|---|---|---|
| Market Segmentation Analysis | * who needs service<br>* what services are needed<br>* what criteria most influence travel choice | * research of public records<br>* surveys of population samples<br>* analysis of existing literature |
| Assessment of Existing Services | * what systems already exist (public and private)<br>* how efficiently and effectively are existing systems performing | * analysis of distribution of existing systems<br>* analysis of performance factors<br>* determination of characteristics of existing systems and rider satisfaction |
| Analysis of Unmet Needs | * geographic service gaps<br>* gaps in rider satisfaction<br>* which existing systems can be better utilized | * analysis of market segmentation data<br>* analysis of assessment data<br>* comparison of market segmentation and assessment data |
| Targeted Design and Implementation | * how can existing systems be modified<br>* what new systems are needed<br>* what are the costs of modifications and new systems<br>* what political and financial considerations must be accounted for | * design and costing of existing system modifications<br>* design and costing of new systems<br>* analysis of local political and financial concerns |

# MARKET SEGMENTATION ANALYSIS

The purposes of this section are:

- To describe and illustrate the concept of market segmentation analysis.
- To describe and illustrate techniques for segmenting a population.

Market segmentation is an approach to transportation planning based on the identification and analysis of groups which are similar with respect to criteria that influence their travel choices.

To begin the process of segmenting the general population, it is useful to look at several of the more prevalent types of trips which people regularly make. This can serve as a starting point for understanding people's travel needs according to trip purposes. The business of defining more exact segments and clusters will be the main focus of this section. The following generalizations are intended to orient readers to the concept of grouping. The groups below are organized according to their trip purposes.

Commuting - people travel to and from work regularly along main corridors by means of private vehicles and mass transit systems.

Business and Commerce - people travel throughout the workday over a wide area using private and commercial vehicles and, to some extent, mass transit systems.

Personal Errands - people travel to and from diverse locations for personal matters: health, social services, banking, etc. Such trips are made by means of private auto or public transit if destinations are located conveniently along the fixed routes.

Shopping - travel to some degree to central locations such as malls and downtown shopping districts. This group tends to use private vehicles because of a need to carry what is purchased.

Recreation and Entertainment - people travel to and from diverse locations at diverse times by private auto or public means when destinations are conveniently located to fixed routes.

Schooling - people travel to centrally located schools and universities. They often use public means and travel to and from diverse locations. Except for a peak of activity in the morning, particularly by secondary school students, this group travels throughout the day.

Determination of Needs

Research and population sampling are the primarly tools for analysis and categorizing the transportation needs of cities and regions. Research based on census and other public records reveals population distributions, basic demographics, and activity centers.

Sampling is a technique for surveying portions of a population to learn about the whole. It can determine the travel needs, desires, and preferences of people. Surveys of sample groups are also used to collect information which categorizes people by neighborhood or district, access to automobiles or public transit, and so on.

A useful vehicle for the administration of survey questionnaires is the employer. Worksites are the ideal locations to reach groups economically and effectively. The cooperation of employers is important not only for survey distribution but also for implementation of ride-sharing services. Employers are generally receptive to such paratransit efforts since the success of these services results in a greater level of punctuality and a smaller requirement for parking facilities.

Contact with public agencies and community organizations can provide additional and specific information about individuals and groups, and can also aid in the distribution of survey instruments. Lastly, existing literature on transportation studies, regional problems,

and paratransit demonstration projects can be useful for directing planning strategy.

Market Profiles

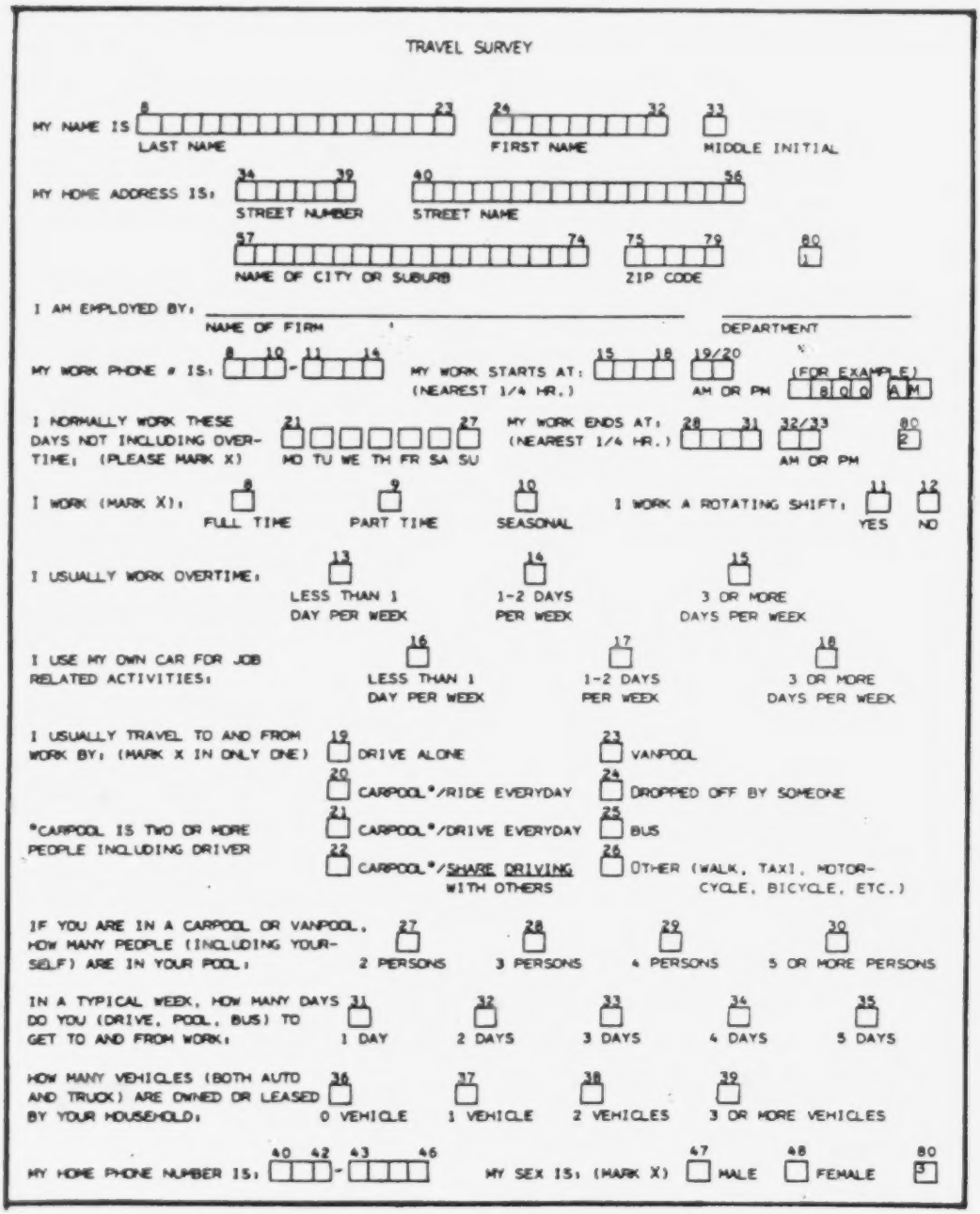
A market profile is a description of a consumer or service user which indicates relevant needs, preferences, and tendencies of travel mode choice. For the purpose of transportation professionals, profiles should indicate those aspects of people's travel patterns such as automobile use which are relevant to system planning.

Preliminary groupings of people (commuters, shoppers, students, etc.) can be useful in designing survey instruments and targeting groups for sampling. For example, commuters predictably travel to the same place each day while shoppers often do not. Therefore, questions concerning regularity and times of trips need to be designed for the two groups.

The following illustration is a travel survey aimed at commuters. Note how the information being sought focuses on general commuter characteristics. (See Figure 3.)

After such a survey has been administered to a sufficiently large number of people, and the data analyzed, subgroups (clusters) can be singled-out and studied for possible services. In this case, ridesharing and pooling were pre-designated as a service option for commuters.

Figure 3. Travel Survey.


TRAVEL SURVEY
MY NAME IS
LAST NAME
FIRST NAME
MIDDLE INITIAL
MY HOME ADDRESS IS:
STREET NUMBER
STREET NAME
NAME OF CITY OR SUBURB
ZIP CODE
I AM EMPLOYED BY:
NAME OF FIRM
DEPARTMENT
MY WORK PHONE # IS:
MY WORK STARTS AT:
(NEAREST 1/4 HR.)
AM OR PM
(FOR EXAMPLE)
I NORMALLY WORK THESE DAYS NOT INCLUDING OVERTIME: (PLEASE MARK X)
MO TU WE TH FR SA SU
MY WORK ENDS AT:
(NEAREST 1/4 HR.)
I WORK (MARK X):
FULL TIME
PART TIME
SEASONAL
I WORK A ROTATING SHIFT:
YES
NO
I USUALLY WORK OVERTIME:
LESS THAN 1 DAY PER WEEK
1-2 DAYS PER WEEK
3 OR MORE DAYS PER WEEK
I USE MY OWN CAR FOR JOB RELATED ACTIVITIES:
LESS THAN 1 DAY PER WEEK
1-2 DAYS PER WEEK
3 OR MORE DAYS PER WEEK
I USUALLY TRAVEL TO AND FROM WORK BY: (MARK X IN ONLY ONE)
DRIVE ALONE
CARPOOL*/RIDE EVERYDAY
CARPOOL*/DRIVE EVERYDAY
CARPOOL*/SHARE DRIVING WITH OTHERS
VANPOOL
DROPPED OFF BY SOMEONE
BUS
OTHER (WALK, TAXI, MOTORCYCLE, BICYCLE, ETC.)
*CARPOOL IS TWO OR MORE PEOPLE INCLUDING DRIVER
IF YOU ARE IN A CARPOOL OR VANPOOL, HOW MANY PEOPLE (INCLUDING YOURSELF) ARE IN YOUR POOL:
2 PERSONS
3 PERSONS
4 PERSONS
5 OR MORE PERSONS
IN A TYPICAL WEEK, HOW MANY DAYS DO YOU (DRIVE, POOL, BUS) TO GET TO AND FROM WORK:
1 DAY
2 DAYS
3 DAYS
4 DAYS
5 DAYS
HOW MANY VEHICLES (BOTH AUTO AND TRUCK) ARE OWNED OR LEASED BY YOUR HOUSEHOLD:
0 VEHICLE
1 VEHICLE
2 VEHICLES
3 OR MORE VEHICLES
MY HOME PHONE NUMBER IS:
MY SEX IS: (MARK X)
MALE
FEMALE

Source: Weisbrod and Eder, Evaluation of the Minneapolis Ridesharing Commuter Services Demonstration, June 1980

Clusters

Profiles are initially made on individuals who are parts of broad travel groups. The data gathered through surveys, however, indicate common characteristics among groups of these individuals. Clustering the sample population according to such common characteristics gives planners the numerical information necessary to access new services.

The importance of designing the initial survey instrument according to desired ends should be recognized along with other technical aspects of survey and questionnaire construction. The data gained from surveys can surveys can only be as good as the information requested.

The following simulation illustrates the sequence of procedures and the progression toward defining market segments and clusters:

A city has a particularly problematic traffic situation stemming from a recently completed office complex. Approximately 4,500 employees have begun working in this complex, many who previously worked in small offices just outside the city and others who are new. Most of these employees have chosen to drive to work since few public services are available to them from outside the city. City planners estimated that more than 3,000 automobiles have been introduced to downtown, complicating traffic and causing severe parking problems.

A survey is conducted to segment the population. The employers agree to assist with administering the questionnaire. It is administered to 1,500 people. The completed questionnaires indicate:

1. Regularity of travel;
2. Time of departure;
3. Work starting time;
4. Point of departure;
5. Work finish time;
6. Method of travel; and
7. Accessible modal options.

(See Figure 4)

Analysis of this data suggests that clusters can be designated by regrouping respondents according to travel characteristics as revealed by the survey. These new groups would then be surveyed again for the purpose of assessing the feasibility of particular paratransit services. The follow-up survey would indicate expected ridership for paratransit options each of which would be designed to meet the time and location criteria of clusters identified in the initial survey.

With such sample survey results, a planner can decide to analyze certain clusters within the market segment. For example, all of the questionnaires of workers arriving between 6:30 and 7:00 AM could be reexamined to see how many shared comon departure points. This would indicate

Figure 4. Sample Survey Results.

| Indicator | Description | Results | |
|---|---|---|---|
| 1 | Regularity of travel | Mon-Fri | 1,350 |
| 2 | Times of departure | 6:30-7:00 | 220 |
| | | 7:00-7:30 | 440 |
| | | 7:30-8:00 | 560 |
| | | 8:00-8:30 | 180 |
| 3 | Work starting time | 8:00 AM | 700 |
| | | 9:00 AM | 740 |
| 4 | Point of departure | North suburbs | 335 |
| | | Greenville | 180 |
| | | South Hills | 280 |
| | | West Greenville | 118 |
| | | Bordentown | 105 |
| | | Other | 430 |
| 5 | Work finish time | 4:00 PM | 380 |
| | | 4:30 PM | 420 |
| | | 5:00 PM | 475 |
| | | 6:00 PM | 220 |
| 6 | Method of travel | Private auto | 1,120 |
| | | Public transit | 205 |
| | | Rideshare | 98 |
| 7 | Available public transit | Public rail | 115 |
| | | Public bus | 280 |

the feasibility of particular paratransit services such as a subscription bus or a ridersharing program.

Ridesharing

The coordination of rideshring programs has been most effectively accomplished through employers or by employers. Several major corporations--Texas Instruments of Dallas, Cenex of St. Paul, and TVA of Knoxville--have included ridesharing coordination as an employee incentive. Such services are generally organized through the collection of application cards. Computerized matching has been particularly effective for the analysis of employer-based ridesharing as the data can be worked into normal employee recordkeeping programs.

With the exception of ridesharing promotion, paratransit services often involve capital costs. Determining the feasibility of these options will be discussed in the following sections.

Summary

The first step in a needs-based planning approach is market segmentation analysis. In this step the transportation planner utilizes quantitative and qualitative data to determine the transportation needs and markets in the service area. Contact with key individuals in the community may lead to later support for proposed solutions.

# ASSESSMENT OF EXISTING SERVICES

The purposes of this section are:

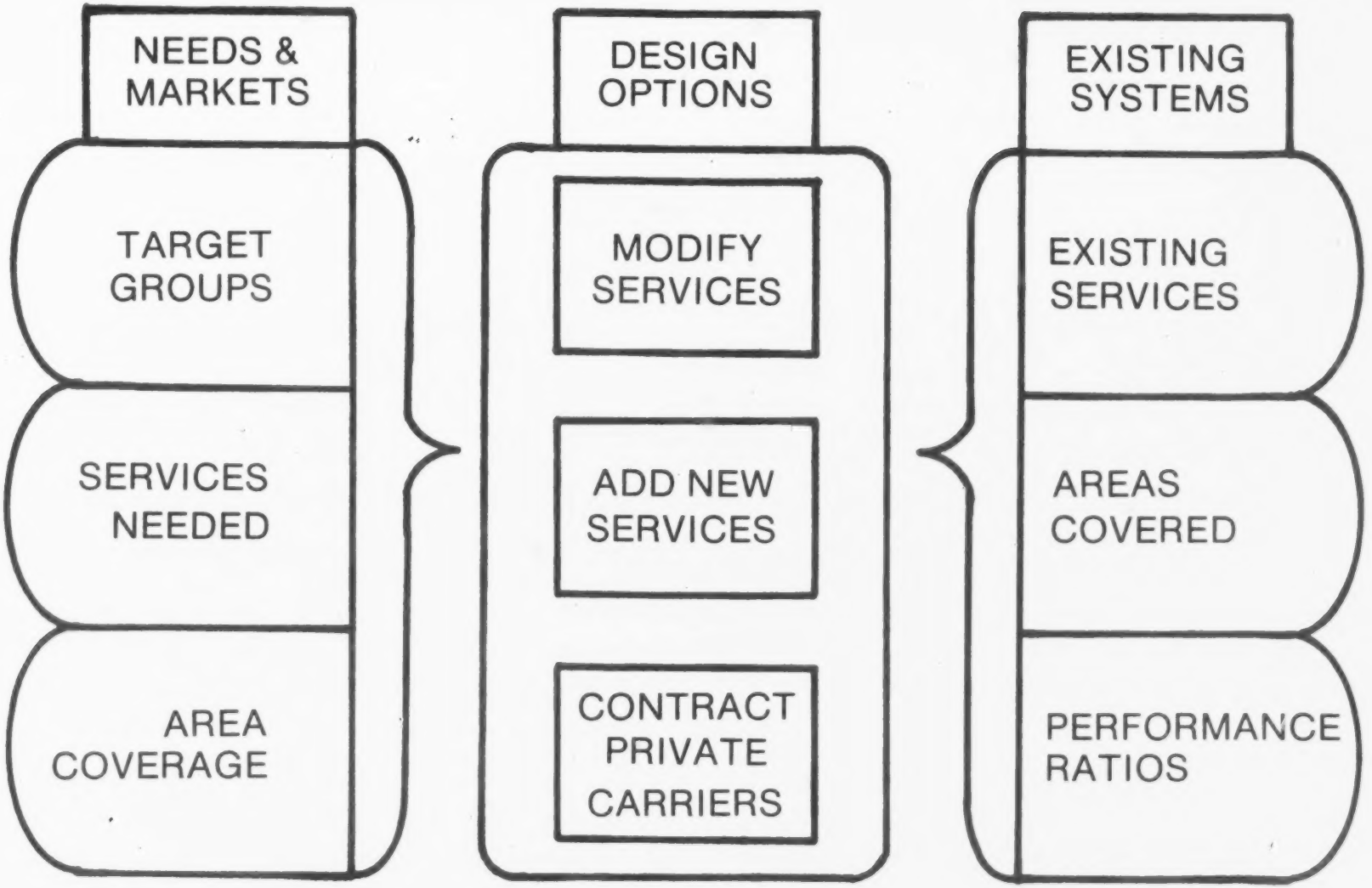
- To describe measures of existing service efficiency,
- To show how existing services are assessed in terms of an integrated planning framework, and
- To demonstrate how simple efficiency indicators are calculated.

## Information on Existing Systems

Market segmentation analysis locates demand areas and indicates what types of service are desired. This information should then be compared with an assessment of existing systems to determine if the existing systems meet transportation needs and if they need modification. Secondly, the economic performance data of existing systems is used to help evaluate their efficiency and the feasibility of potential new or modified services. (See Illustration 4)

Generally, the performance data of existing systems already exists. Transit planners need to obtain access to system budgets and related financial and service records. Also, since private carriers such as taxi and van services can play a role in paratransit, their operating capacities,

Illustration 4. Utilization of Assessment Plan.



costs, and regions of operation, when available, should be included in this phase of planning.

## Assessment Techniques

Transportation planners and managers need a working knowledge of the diverse, but interrelated, elements which comprise the transit network. Vehicle engineering, economics, legalities, market needs, market potential, and system performance are all components in this decision process. Assessment of services concentrates on system performance measurements and the resultant economics.

Basically, existing services are initially evaluated in terms of two questions:

1. What is the nature of the service being provided?
2. Is this service being provided in a cost-effective manner?

## Operational Factors

The nature of existing services can be described in terms of what service is provided when, where, and to whom. Operational factors are those which are determined by management decisions. They include:

- fares,
- times of operation,
- routes or zones of operation,
- accessibility,

- headways,
- communication with users, and
- safety.

The transportation planner should also attempt to determine who uses the system. It is very important in the planning process to know which market segments use the system and at what times. This information can help in determining unmet needs in the area and in tailoring system characteristics to increase ridership.

System User Assessments

It is important to interview selected users of the system to obtain their opinions of the operational characteristics listed above. Factors such as the level of driver assistance or the availability of route information cannot be analyzed solely on the basis of written service and financial records. The planner should also ride the various services in the system regularly to augment other user assessments.

Assessments by system riders can help to identify both system strengths and problems which decrease ridership. In addition, user assessments are an essential element of market research and are an essential first step in efforts to promote ridership of new and existing services.

## Economic Performance Factors

The impact of a system's operational factors is reflected in its ridership and in its economic feasibility. Many measures exist to determine the economic efficiency of a transportation system. Calculating these factors and analyzing the results permits the economic evaluation of systems as they exist and as they could be modified. Some of the most common performance indicators for a particular service are:

- vehicle cost per year,
- operating cost per year,
- ridership,
- cost per vehicle mile, and
- cost per passenger mile.

## Computation of Performance Ratios

The following is an illustration of simple computations for basic performance ratios. The numbers are taken from Figure 5 which appears on the next page.

Computation of performance ratios from Figure 5:

| | | |
|---|---|---|
| Annual vehicle capital cost | = | cost of vehicle/expected useful life<br>$127,370/10 years = $ 12,787 |
| Operating cost: | | The sum of non-capital expenses associated with vehicle operations including administrative and overhead<br>$ 26,065 |

Figure 5: Hypothetical Data on Single Subscription Bus with Part-time Driver.

| | |
|---|---|
| Annual miles | 12,600 |
| Average speed | 25 mph |
| Labor cost/year/vehicle | $ 10,090 |
| Fuel/year/vehicle | $ 1,512 |
| Maintenance | $ 5,871 |
| Insurance | $ 3,049 |
| Administration | $ 5,392 |
| Fees and Licenses | $ 151 |
| Total Operating Cost (without capital) | $ 26,065 |
| Vehicle cost/year | $ 12,787 |
| Total cost | $ 38,852 |
| Average occupancy per trip | 31 |
| Average capacity | 53 |
| Total round trips per year | 250 |
| Expected vehicle life | 10 years |

| | | |
|---|---|---|
| Ridership: | | Average passengers per roundtrip multiplied by annual number of trips |
| | | 31 x 250 = 7,750 passenger roundtrips |
| Cost per vehicle mile (vehicle miles): | | Total cost per year/total miles |
| | | 38,852/12,600 = $ 3.08 |
| Cost per passenger mile: | | (Total cost/year)/(passenger miles/yr) |
| Passenger miles/year | = | (avg occupancy)x(number of trips)x (total miles/number of trips) |
| | | OR |
| | = | (avg occupancy)x(total miles) |
| | = | 31 x 12,600 |
| Passenger miles/year | = | 390,600 |
| Cost/passenger mile | = | (Total cost/year)/(passenger miles/yr) |
| | = | $38,852/390,600 |
| | = | $ 0.0996 |

The analysis of these results depends on the characteristics of the system studied. A demand-responsive service in wheelchair lift vans will cost more per mile to operate then the subscription bus described above. It is necessary to analyze as many indicators as possible in light of a system's operational characteristics to evaluate its economic efficiency.

In addition to the analysis of specific services, it is important to study the budget of the overall system so that possible inefficiencies can be identified and so that the incremental costs of proposed new or modified services can be estimated. Adding a supplemental service using a new van to a fleet of vans will cost less than adding the same

van to a fleet of vans will cost less than adding the same service and van to a fleet composed entirely of buses. Some of the affected budget categories would include maintenance, insurance, and administration.

Paratransit and Cross-Modal Benefits

Benefits derived from paratransit services can have favorable effects on other transit systems; these are termed cross-modal benefits. An example of this would be the implementation of a mini-bus feeder line which serves to increase ridership on a fixed rail or bus system and reduces the number of commuter automobiles. Improved economic performance of the fixed-route system and reduced congestion would be the cross-modal benefits.

While considering improvements for existing systems or the introduction of new systems, the probable side effects of these proposed changes need to be examined. The likelihood of resultant cross-modal benefits represent a positive aspect of paratransit which should appear in assessment computations.

Quantitatively estimating cross-modal benefits is difficult. It is a topic which is currently receiving considerable attention. As with other assessment techniques, the survey instrument can play a significant role in obtaining useful data. Given specified proposed

options, questions regarding modal choices can be built into an initial survey questionnaire or can be sought by separate survey instruments.

## Summary

The second phase of a market-based transportation planning process is the assessment of existing services. The operational and economic characteristics of existing public and private transportation systems should be analyzed to determine at what cost and in what manner service is being provided in a given area. If a variety of services is being offered it is important to assess their cross-modal impacts.

# ANALYSIS OF UNMET NEEDS

The purposes of this section are:

- To show how needs and services are compared to determine areas of unmet needs, and
- To illustrate the types of unmet needs which may be discovered.

Market segmentation analysis categorizes the population into groups according to their needs and preferences, and estimates the sizes of such groups. Assessments of existing services evaluate the ridership, location, operating performance, and economic feasibility of existing systems.

A comparison of the data on market segments and existing services will reveal areas for improvement in the transit network of a given city or region. Unserved needs uncovered by this comparison can be interpreted in a variety of ways depending on the nature of the system, its users, and local priorities.

Forms of Unserved Needs

Service gaps can appear in several forms, among them: specific trip demand, special user groups needs, and unserved geographic areas.

Specific Trip Demand refers to transportation needs which begin and end at specific locations at regular times. Commuter work trips are the most common example of spcific trip demand but this category also includes travel by groups of people to any organized activity such as a concert, fair, or sports event. It is often a straightforward process to design services for such specific markets. Often, the type and size of vehicle can be selected according to the characteristics of the specific trip to be provided, and the times and route of travel are predictable.

For example, in one suburb, 45% of the workers were found to be driving alone to the same train station every morning along the same two lane road. If one-quarter of these people would ride a convenient feeder service, then congestion and the cost of travel would be reduced for all of the commuters on that route. In another example, downtown merchants were invited to underwrite a free shuttle bus on game days to a major college football stadium to increase their business. This relieved both parking and congestion problems.

Special user groups are primarily the transportation disadvantaged and the transportation handicapped. They can have needs for specific types of transportation service. People with certain disabilities may need specialized service or the availability of vehicles with special equipment. The key issue is whether different groups of people have access to viable transportation services.

In fact, transit properties are required to make every reasonable effort to provide transportation service to all people in their communities in order to receive federal support. Examples of services which can meet the needs of special user groups include lift-equipped buses, demand-responsive systems such as dial-a-ride, and user-side subsidies provided to certain groups.

The transportation planner must investigate the size, nature, and needs of special user group needs before proposing new or modified services. A simplified description of this process is presented in the example at the end of this section.

Unserved geographic areas should be identifiable from local transit maps and survey data. However, lack of transit service is relative. An elderly person in a neighborhood where she fears street crime may feel that she is unserved if the bus does not stop within 200 yards of her residence while her college age grandson may think little of walking a mile to a busstop to reach his classes.

Unserved neighborhoods can lie within or outside the boundaries of the public transit network. In many cases, survey data can be used to determine whether there is sufficient ridership to support the extension of an existing fixed-route system, or to support a paratransit option.

Quality of Service

Quality of service can be considered an unmet need if, for example, unclean buses discourage potential riders from using public transportation. By improving bus maintenance, ridership could be improved and the system could function more efficiently while meeting more needs. Similarly, low-cost actions such as repainting or new maps may produce measurable ridership and revenue improvements.

Market research such as surveys and interviews can be useful in identifying how aesthetic and other service quality factors are perceived by potential riders. Negative quality factors can be investigated to determine if service quality increases are feasible and cost-effective. Factors that the public views positively can be utilized as part of the system's promotion.

Summary

Determining unmet needs requires analysis of market segments and of existing system data. Needs and demands for public transportation service are compared with data on the operational performance of existing services. Planners can then identify unmet needs and evaluate potential new and modified services. Mobility needs can be of several types including specific trip needs, special user needs, and geographic needs. Unmet needs can also take the form of inadequate quality of service on existing systems. Only after unmet needs have been identified can new and modified systems be designed and assessed.

## TARGETED DESIGN AND IMPLEMENTATION

The purposes of this section are:

- To describe the process of system design and selection in the context in the overall planning.
- To discuss the political implications of system design and implementation.
- To illustrate system design and the process of implementation.

The design and implementation of paratransit services must be done in direct response to specified needs and preferences of potential users. As it has been determined by virtually all demonstration and pilot projects (those that succeeded and those that failed), unless a service meets the individual needs of riders, it will not be used. It should not be assumed, however, that design and implementation of modifications and new systems are simple.

Practical and logistic considerations must be placed beside hard data before solutions can be proposed. Proposed solutions must then be evaluated in light of financial and.

Political factors to assess the realistic possibility of implementation. It is necessary for transportation planners to have a working knowledge of related institutions and issues and to understand the impact of their work on the entire community.

(See Figure 6 and Illustration 5)

Factors for Design

Needs-based planning determines modal characteristics for new systems, and the criteria for improving existing systems. Generally, the factors which emerge as most influencial in final design are:

- The needs of designated groups;
- The size of individual clusters;
- The location of unserved groups; and
- The economic feasibility and characteristics of modes and vehicles.

Recommendations for system design and modification require consideration of logicstic, technical, economic, and social factors. That is to say, final design is a complex process. What follows is a brief summary of the elements of each of these factors.

Logistic - determining an optimum number of vehicles; the best routing patterns; and the combination of modal options to serve the most needs in the best way.

Illustration 5. Principal Groups Involved in the Transportation Decision-Making Process.

Source: Technology Sharing, 1978, p. 29.

Figure 6. Principal Groups Involved in the Transportation Decision-Making Process.

| GOVERNMENT | CITIZEN GROUPS | BUSINESS COMMUNITY |
|---|---|---|
| Local | Advisory Boards | Chamber of Commerce |
| County | Fraternal Organizations | Developers |
| Metropolitan | Howmowners | Labor Unions |
| Regional | Individuals | Merchants |
| Special District | League of Women Voters | Newspapers |
| Transportation Authority | Neighborhood Groups | Taxi Companies |
| State Department of Transportation | Parent Teacher Associations | Transit Operators |
| Other State A-95 Agencies | Peace Groups | |
| Federal Department of Transportation | Religious Groups | |
| Other Federal Agencies | School Groups | |
| Law Enforcement | Service Clubs | |
| Public Safety Agencies | | |
| Welfare | | |
| Health Agencies | | |

SOURCE: Technology Sharing, 1978, p. 29.

Technical - the operating efficiency of individual vehicles; special needs modifications, such as lifts and ramps; required maintenance equipment and training.

Economic - the capital cost of investment; start up costs; operating costs; expected income from fares; and sources of funding.

Social - what groups will benefit from new services; what is the economic impact of new services; what social and personal needs are to be met.

Factors for Implementation

Since financial resources are generally limited and subject to political influence, planners must organize their analytical results and make recommendations according to:

- What is the range of needs:
- What is the cost of meeting each of these needs;
- What needs should take priority over others; and
- What is the potential for system implementation within the local political context.

Political Factors

Transportation planners and managers work within social and political systems, so proposed changes are not usually easily implemented. Many parties have a stake and an interest in public transportation services. These include

the transit rider, the transit worker, the taxpayer, the downtown employer, the motorist, and so on. All have different interests, perspectives, and methods.

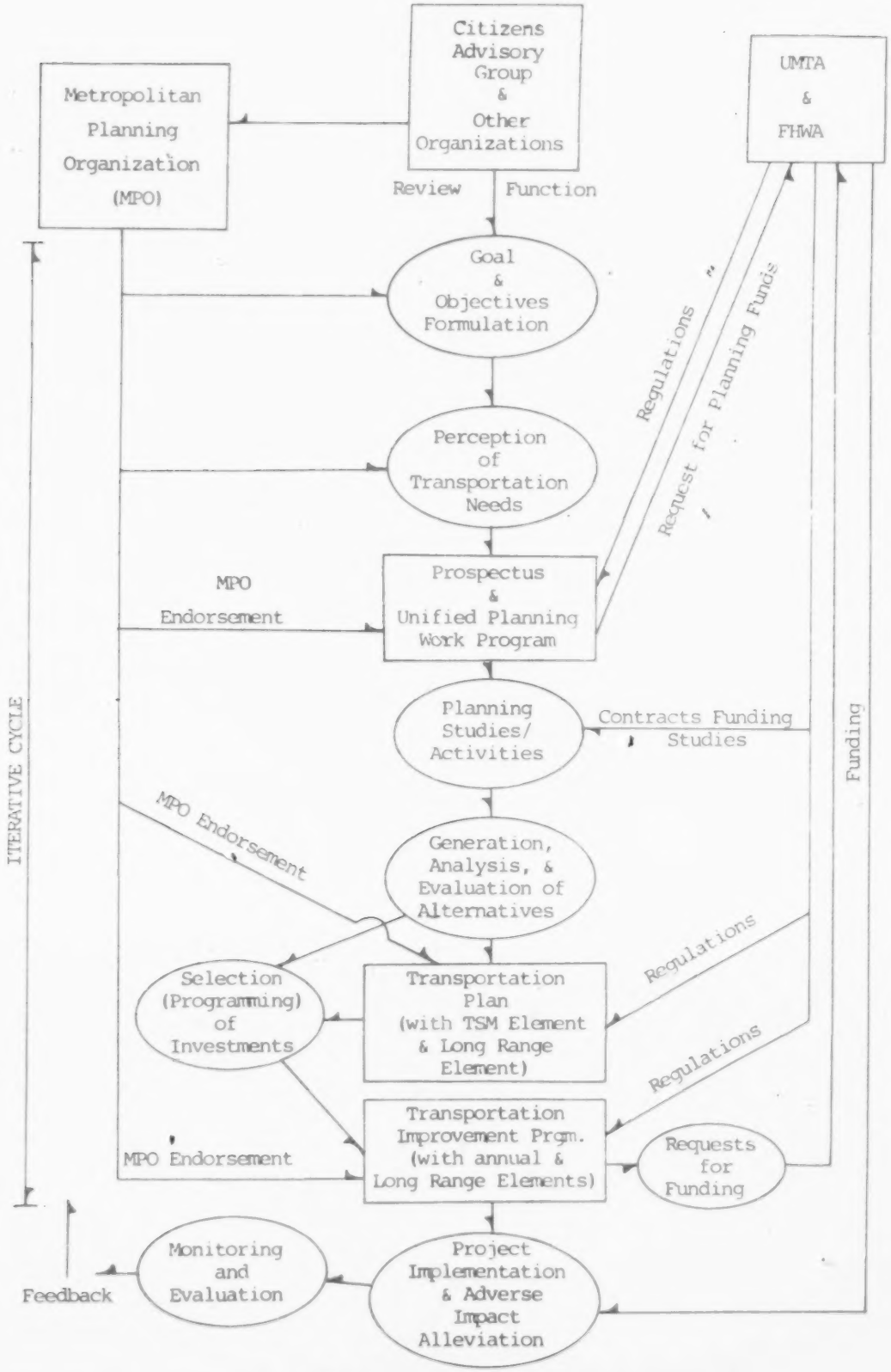
Transit workers are justifiably concerned about their work conditions and financial compensation. Taxpayers are equally justified in their concerns about the benefits they will derive from their tax dollars. Transit riders wish to see transit services which will better meet their individual needs and downtown merchants are interested in attracting shoppers to their stores. Often systems cross jurisdictional boundaries further complicating political decision-making as each jurisdiction is concerned that it receives a reasonable service for its financial contribution.

The actual process of obtaining federal funding for public transportation systems is long and complex as illustrated by Figure 7. As discussed above, potential modified or new systems will be scrutinized by any number of interested parties. The nature of this process makes it mandatory to develop political support for new transportation systems <u>during</u> the initial planning process and not wait for a finished plan before assessing its political feasibility.

Even sympathetic local governments will alter the most carefully researched systems design in order to meet other

Figure 7. Planning Process to Obtain Federal Funding.





priorities. The following simplified case illustrates how systematic planning was used to determine design characteristcs and how this design was then fit into an overall financial and political framework.

The Case of Santa Fe, New Mexico

In 1977 the Mayor of Santa Fe, in response to community requests, appointed a Public Advisory Committee to undertake a needs-based transportation planning project process for the city. The results of the planning steps are summarized below.

Market Segmentation Analysis was conducted from analysis of census data and from surveys. Some of the major conclusions of this analysis were that:

- 14.7% of total households in Santa Fe do not own a car (as compared to a national average of 13%)
- In 7 of the 12 census tracts, more than 40% of the population is 18 years of age or younger; in half of the tracts, 15-30% are 60 years or older.
- 57% of the telephone survey respondents indicated a willingness to pay additional taxes to finance public transportation services.

- 7% of the telephone respondents indicated their household had a handicapped member. 62.5% indicated that the individual's disability caused severe transportation problems.

- 64% of the telephone survey respondents and 58% of the community rated public transportation at least of equal importance with other municipal services.

Personal interviews with leaders of community organizations revealed that:

- taxi service was inadequate in Santa Fe;

- there was a perceived need for public transportation, and the belief that citizens would support a transit system;

- there was opposition to a city-operated system; the dominant view was that service should be provided by a private operator with assistance from the city; and

- service for the elderly and handicapped should be the number one priority.

Assessment of Existing Services revealed that:

- taxis were the only means of transportation for the general public, and that from 1975 to 1978 the total number of cabs had decreased from 11 to 4.

- all other transportation services were restricted to specific clientele and were of limited size.

Analysis of Unmet Needs was conducted by placing the needs and preferences alongside the existing services. Given the low level of existing service, the planners were basically able to assume that all needs for public transportation were essentially unmet. Groups, which were especially disadvantaged by lack of services, were then designated as:

- low income residents;
- carless households;
- the elderly;
- the young; and
- the handicapped.

In addition, they noted the large percentage of local residents who believed Santa Fe needed a form of public transportation.

A system was then designed based on the previous planning steps. First, the Committee prioritized the transportation needs in order of importance. This basically involved local political concerns. The top five priorities were, in order, the handicapped, the disadvantaged, the carless, the elderly, and commuters.

With their priorities clear, the Committee began to consider specific alternatives which included:

o Fixed-Route Bus Service Service - a city-owned system available to the public at the standard fare.

- Dial-A-Ride Bus Service - city-owned shared-ride vehicles providing door-to-door service on demand..
- User-Side Subsidy - fare discounts to specific groups using privately-owned shared-ride taxi services.

The fixed-route bus service would have been of little use to the top-priority handicapped segment because it was not door-to-door. Given the lack of a local taxi fleet to contract with for a user-subsidy program, the Committee selected Dial-A-Ride as its top priority.

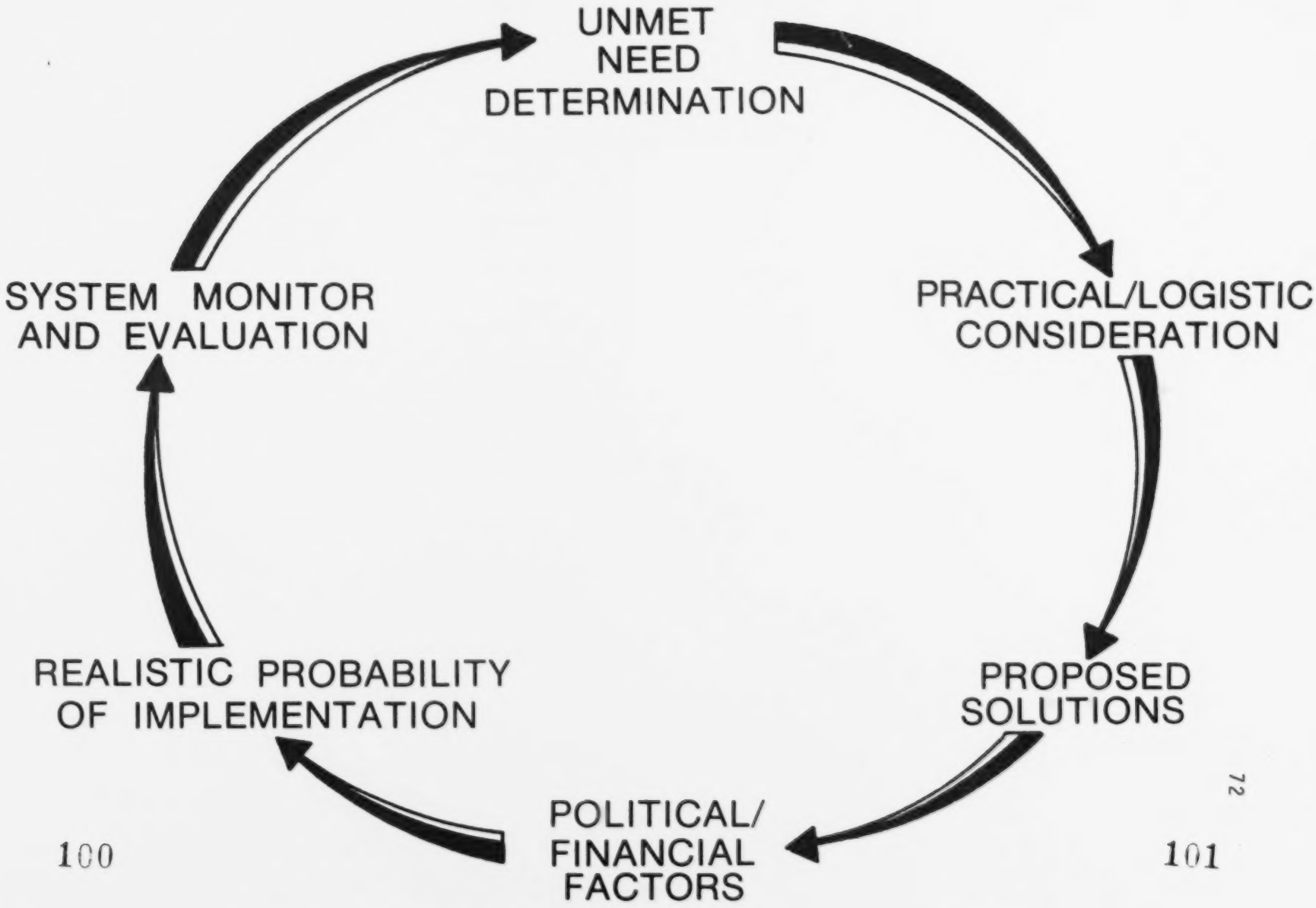
However, the city chose the user-subsidy program because it was far easier to implement than buying a fleet of Dial-A-Ride vehicles. Administrative and financial investments were far less, and the proposed operating costs were similar. Lastly, to increase the number of taxis, the city recruited and contracted with a large taxi company to begin operations in Santa Fe under the new program.

Summary

Targeted design is a two-phase process. The planner must first design transportation systems based on local needs, existing systems, and cost effectiveness. At the same time, the political and fiscal environments must be continuously assessed to determine the feasibility of implementing the resulting proposals.

Neglecting either of these phases will lead to failure, while attention to both will not guarantee success. The complexity and difficulty of transportation management is clearly revealed by attempts to implement new services or alter existing ones. Illustration 6 shows how system planning is a continuous process which does not conclude just because an innovation is implemented.

Illustration 6. The Transportation Planning Cycle



## STUDENT REVIEW

1. Discuss several ways by which planners can gather data to learn the transportation needs of their cities and regions. Specify sources of data and the nature of information from each of these.

2. Construct a transit needs questionnaire which would indicate groups of students at your university that need regular transit service.

3. Using Figure 8, on the next page, calculate:
   a. annual ridership
   b. cost/vehicle mile
   c. cost/passenger
   d. cost/passenger if ridership increased to 50% of capacity

4. Compare the figures obtained from Question 3 with those calculated previously for the subscription bus service (See Figure 5, pg. 51). Why does the DRT service have lower ridership/capacity and higher costs/passenger?

5. Find an unmet transportation need or demand in your area and interview a person affected by it. Report your findings to the class and discuss possible services which could meet the need.

Figure 8:
Hypothetical Data for a DRT Van
with 2 Full-Time Drivers

ANNUAL COSTS

| | |
|---|---|
| Labor | $ 31,874 |
| Fuel | $ 3,600 |
| Maintenance | $ 7,200 |
| Insurance | $ 1,740 |
| Administration and Dispatching | $ 20,720 |
| Fees & Licenses | $ 240 |
| Total Operating Cost Without Capital | $ 65,374 |
| Capital (Vehicle) | $ 3,840 |
| Total | $ 69,214 |
| Annual miles | 30,000 |
| Avg. Occupancy per hour | 2.4 |
| Capacity of Vehicle | 12 |
| Hours of Operation per year | 3536 |

## GUIDELINES FOR STUDENT REVIEW

1. a. Surveys can be administered to employers or to the general public to learn of the specific travel needs of individual groups or districts.
   b. Contact with the public agencies and community groups can reveal the travel needs of specific groups.
   c. Existing literature, such as studies and reports, can document problems and solutions for particular settings.

2. Guidelines should be established by the professor.

3.. Annual Ridership . . . . . 8,486
   Cost/Vehicle Mile. . . . . $2.31
   Cost/Passenger . . . . . $8.16
   Cost/Passenger at 50% capacity . . . $3.26

4. The DRT service has a lower ridership/capacity and higher costs than a bus pool in part because in the DRT system:
   a. each passenger is picked up at an individual time and location
   b. each boarding requires time;
   c. the vehicle must follow a separate route for each passenger;
   d. the vehicle has its fixed costs divided by a far lower capacity; and
   e. the DRT system has high administrative costs associated with the scheduling and routing of the vehicle and management of fares.

5. To continue this discussion, discuss the political and financial feasibility of implementing the solutions proposed for particular needs. Would they be utilized and cost-effecive, or would they be inefficient and costly?

# FINANCING PARATRANSIT

The purposes of this section are:

- To familiarize students with the existing framework for financing paratransit operations.
- To acquaint students with the current state of financing for paratransit operations.

Research on the effectiveness and feasibility of paratransit systems has taken place almost exclusively through demonstration projects funded by the Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA). The problems and risks associated with implementation of new transit and paratransit systems on a private investment basis are considerable. Private taxi and bus franchises operate within rigid legal frameworks. Union and publicly-employed drivers are protected by federal laws against loss of their jobs. In addition, the capital, maintenance, and operating expenses of vehicle fleets require large investments with no guarantee of payback.

Start-Up Costs

The federal government continues to finance research and demonstration projects. Such grants are of two types, planning and implementation. Funds for planning are generally used to determine characteristics and sizes of potential rider groups in areas or regions, and to recommend which systems and modes should be introduced. Funds for implementing systems are designated for the purchase of venicles, where recommended and approved, and the costs of operation for a limited time. Funding for the continued operation of systems is generally contingent on the initial success of the project and on government spending priorities.

Many systems have succeeded on their own beyond the period of federal funding either in whole or in part. The Pittsburgh ACCESS program, for example, continues to operate under contract from the city in the management and coordination of social service and demand-responsive riders. In general, however, paratransit systems are new enough that their ultimate role and economic feasibility cannot yet be fully defined.

Outside Financing

The unique role of paratransit in providing individualized and economic "trip-demand" service makes it possible to find alternative sources of financing. This has been demonstrated by the number of companies that have

decided to purchase vehicles for use by employee pooling groups. The savings in parking lot construction and maintenance, as well as the improved regularity of workers arriving at and departing from work, offer convincing arguments. Employers can also help offset the costs of ridesharing feasibility studies by permitting and assisting agencies to survey workers.

Vans and Bus Pools

Coordination and facilitation of ridesharing and pooling is one means of providing low-cost paratransit services. Vans and bus pools are commonly sponsored by third parties, often public transit agencies. The employer or sponsoring agency can lease the vehicle or purchase it outright, and, in turn, lease it to a group of commuters either directly or through a broker. Fares are set so as to cover all costs, including depreciation and insurance. Van pools, in particular, are one of the most cost-effective methods of commuting, particularly for long distances. A recent Congressional Budget Office study estimated that the average cost per passenger for a 10-mile, one-way commuting trip in a metropolitan area is 5.7 cents for a ten-member van pool, as compared to 23.1 cents for a bus.

The two financial profiles that follow illustrate two types of van pool operations. In Norfolk, the target commuter population was estimated at 86,000, all working at

the U.S. Naval Base. In Golden Gate, the commuter work-force was estimated at 140,000, all working at various locations in San Francisco, but all traveling along a targeted northern corridor. The Norfolk project purchased and operated the van service. In both cases, initial financing came from the Urban Mass Transit Administration. (See Figure 9)

In addition to financing and managing paratransit services, which involves the purchase or leasing of vehicles, transit agencies can act to promote and coordinate ridesharing and pooling for local employers. The promotion of vanpools programs by major employers is increasing nationwide as its benefits are becoming better understood and the efforts of transit agencies are one of the causes.

User-Side Subsidies

> User-side subsidies are discounted ride tickets provided to targeted groups for the purchase of transportation services.

Since 1976 user-side subsidies have entered into the economics of transit and paratransit services. When used in conjunction with a public transit system, such a strategy

Figure 9. Budget Breakdowns of Two Demonstrations Vanpool Projects (1978)



| | Norfolk | Golden Gate |
|---|---|---|
| DIRECT LABOR | | |
| Professional Managerial | $ 73,000 | $ 133,200 |
| Clerical | 11,000 | 52,700 |
| Subtotal | $ 84,000 | $ 185,900 |
| OVERHEAD, BENEFITS, ADMINISTRATIVE, & TRAVEL | | |
| Employee Benefits | $ 8,000 | $ 74,900 |
| Overhead | -- | 26,100 |
| Travel | -- | 10,000 |
| Other Administrative Costs | 20,000 | 73,500 (1) |
| Subtotal | $ 28,000 | $ 184,500 |
| SUBCONTRACTS AND OTHER DIRECT COSTS | | |
| Consultant Service | -- | $ 36,000 |
| Marketing | $ 20,350 | -- |
| Direct Cost of Operation | 25,000 | -- |
| Other Project Costs | 5,000 | -- |
| Contingencies | -- | 10,000 |
| Subtotal | $ 50,350 | $ 46,000 |
| CAPITAL COSTS | | |
| Vans | $ 327,650 (2) | $ 321,800 (3) |
| Subtotal | $ 327,650 | $ 321,800 |
| PROJECT COST | $ 490,000 | $ 738,200 |
| SMD Grant | $ 490,000 | $ 738,200 |
| Other | -- | -- |

(1) Includes marketing

(2) Purchase of 50 Dodge 300, 12 passenger vans, bench seats, @ $6,553 each

(3) Purchase of 35 Plymouth Voyager vans: 18 with bench seats, 17 with reclining seats

tends to increase the numbers of riders using the system for which the subsidies are designated. This has had positive effects in that it acts to lower system deficits by moving more money through the system.

In reality, many user-subsidy programs are run by the government but the specialized service is provided by private operators such as taxi companies. The transit agency acts as a broker and contracts with these companies to accept the ride tickets and submit them for reimbursement. In this way the agencies cost is limited to the actual cost of the subsidies plus administration.

User-side subsidies are financed by local, state, and federal taxes, and by state lotteries. The use of user-side subsidies represents a means whereby targeted segments of local populations are given the opportunity to take advantage of existing systems, both public and private. Common recipients of these subsidies include the elderly, the disabled, and low-income groups. With these subsidies, the designated user groups are better able to travel and transportation providers realize increased ridership.

Summary

Financing paratransit operations varies with the type of system to be funded and with local, state, and federal funding priorities. Involving the private sector as service providers can reduce capital costs, while involving major employers in vanpool programs can cost very little. User-side subsidies are another means of providing targeted services without developing entire new systems.

# MARKETING PARATRANSIT

The purposes of this section are:

- To make the student aware of the critical role which marketing plays in modern transportation.
- To familiarize the student with the basic elements of transportation marketing.

Active and ongoing promotion is necessary for any new product or service. Suppliers generally do this through advertising and public relations. A promotion is designed to highlight the benefits of a product or service so that the general public is influenced to consider what is being promoted in terms of their own lives. Whether we fear bad breath or are bullish on America, we are all influenced by advertising. Transit and paratrnsit services represent choices, and, as such, need to be visible and promoted.

## Visibility of Systems

Commuters, as well as the general public, are flooded everyday with the sight of passing vehicles. Paratransit vehicles must operate within this flow and for the most part blend into the myriad of colors and shapes. In

recent years, however, minibuses with the words DIAL-A-RIDE boldly printed on all sides have begun to appear as singular items in the otherwise indistinguishable lines of vehicles. Similarly, special purpose vehicles for the handicapped can be made to carry a message. The same holds true for commuter vans and buses.

This element of visibility is an important form of ongoing promotion for paratransit. A commuter sitting alone in an automobile in a stalled line of traffic cannot help but think of pooling when a distinctive van or subscription bus filled with happy people passes by in a "high-occupancy vehicle" (HOV) lane. Likewise, the harried shopper, angered by the slowness of a checkout line and worried by the expired parking meter two blocks away, must stop and think when a DIAL-A-RIDE minibus pulls up and a rider casually climbs aboard.

User Input in Planning

The idea of systems selling themselves is not enough. Nor is it possible to design a promotional campaign to save a system which was poorly planned and does not provide needed services. What is necessary is to start system planning with an integrated view of the product (service), price, and promotion which will be provided.

Because paratransit systems require the commitment and cooperation of specific user groups, a plan to locate and

recruit these groups is essential. Much can be done to attain these objectives during the initial planning. The direct involvement of people in an enterprise is a proven technique in gaining support. Such involvement begins with conducting surveys and meeting with groups.

The involvement of local people in analyzing the transportation needs of their neighborhoods can go a long way in ensuring interest. Follow-up reports to them on the results of planning efforts is another element of this strategy. Community groups and leaders should also be included in the design and implementation stages. They can often provide information that planners "from other parts of town" would not otherwise know about. The importance of local input should not be underestimated since cooperation and participation at the local level is the foundation of system success.

## Planning a Marketing Strategy

Marketing strategy should begin during the first stages of paratransit planning. Market segmentation analysis provides insights into the needs and preferences of the general population as well as specific segments and clusters. Analysis of existing services reveals which systems have adequate ridership and which suffer from unused capacity.

Making the System Known

Strategic planning and design should lead to the selection of the best mode for targeted rider groups, but, again, products do not sell themselves. No matter how appropriate a system may be, its existence and benefits must be made known to the public. Since paratransit services are aimed at individual segments, advertising of the services should be done directly to the segments and should highlight the service benefits.

An example of this would be the announcement of a special shopper's minibus from a particular housing development. It would be distributed at the housing development and clearly state the times of service, location of pick-up points, and fares. The promotion would highlight convenience, reliability, and courteous service. It might also remind people that their input was responsible for the existence of the service.

Ridership data which is generated from the assessment of existing services provides useful information for marketing. Analysis of why some systems enjoy a sustained ridership can reveal strategies for developing or increasing ridership for other services.

Destination is a Key

The nature of transportation is that it is a means of getting people to and from desired locations. That is to say, it is not an end in itself. Although this may seem obvious, it is an important concept in marketing of services. Because a new bus is fast and streamlined, and offers half-priced fares, people will not ride it if it does not go where they want to go. Destination is a prime determinant of ridership, so destination should be the basis of the marketing message. Similarly, system maps should be clearly written and easily obtainable.

Marketing Ridesharing

In general, pooling results in people arriving to work on time regularly, and it is significntly less expensive for a rider than driving alone. Because of its desirability to workers, pooling services are now promoted as an employee benefit. From a company standpoint, the use of vans to carry as many as twelve people to and from work can eliminate the need for much of the parking space that was believed essential ten years ago. This results in considerable capital savings in construction and maintenance which more than justifies the purchase of vehicles.

The benefits of pooling and ridesharing are well documented, yet organizing and implementing such paratransit systems can be difficult. The cooperation of

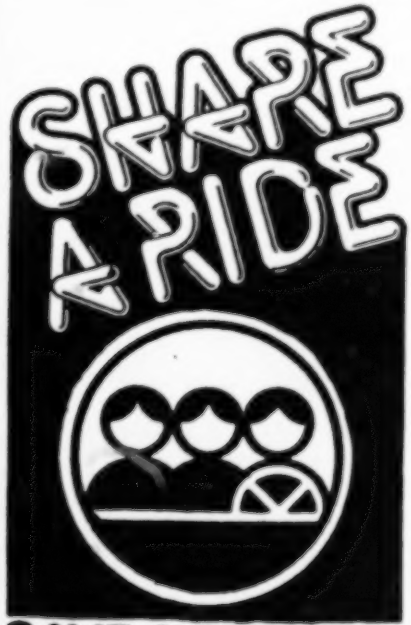
employers is essential to these types of operations because the place of employment is the primary common characteristic of potential users. Marketing ridersharing to employers and employees is an evolving job for planners, managers, and brokers. Many successful vanpools exist today, and this trend will continue partly because they do benefit employers as well as employees. Many larger companies subsidize vanpools by purchasing or assisting in the purchase of vehicles.

Ridesharing is only one type of paratransit and, in many ways, the simplest to implement and promote (see Figure 10). It has a direct and immediate influence on reducing traffic and can be a convincing alternative for solo-driving commuters. Promotions for pooling and ridesharing are often done through radio and t.v. spots, on billboards, in newspapers, and directly through places of employment. Some cities have set up ridesharing hot lines and computerized ride and rider matching services. As with all aspects of managing paratransit services, marketing requires imagination and an understanding of the community.

## Sustaining Ridership

Sustained ridership will depend on maintenance of the quality of service and on continued promotion. It is important to note that promises made in advertising material must be followed up by service that matches these. Ongoing evaluation will help determine which

Figure 10. Sample Ridesharing Promotional Brochure.

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$575 a year
...just by changing
the way you
ride to work!

**We're "Share a Ride", and the $575 is approximately what you can save if you don't drive your own car to work alone everyday.**

Now, before you go stiff in your chair over the thought of not having your very own car sitting out there in the Company parking lot all day everyday, consider some of the advantages of sharing a ride to work.

You're going to save a lot of money... real, spendable, tax free income just because not driving will cost you less.

Depending on the car you're driving, you may save a little more or a little less than our $575. If you're driving a '39 Volks powered by a rubber band, chances are you've beat the system. If you're tooling to work in a '78 Mercedes 450 SEL, we're about to save you a bundle.

Most days you'll be driven to work, and that's easier on you. Parking gets easier because there are fewer cars on the lot.

If you're a one car household, leaving the car at home will help others in your family get around.

And Share a Ride is a neat way to meet some new folks.

**There are three ways to "Share a Ride". Which one interests you most?**

**CAR POOLING**

We do all the work... supply you with the names, addresses and phone numbers of people in your area going to the same work location. We'll even suggest how you split the expenses. All you folks do is get together. And, it's flexible... you don't have to ride everyday. Plus the fact that car pooling may qualify you for a discount on your auto insurance.

**VAN POOLING**

This is different, but so are the benefits. You could wind up driving a nifty Dodge or Plymouth Van for free. Use it for your personal needs, too. How about that!! Or, at the very least, you wind up being chauffered to work in style & comfort... with time to read the morning paper. Once again, we do all the work, and all the organization... all you have to do to get started is indicate your interest.

**REGULAR BUSES**

We provide the schedules, pick out the best route for you to ride, and sell you the MTC "All you can ride" monthly pass. You just climb aboard, and start saving that $575.

Source: Evaluation of the Minneapolis Ridesharing Commuter Services Demonstration, 1980, p. A-3



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strategies work and which do not.

In addition to standard advertising strategies, several uniquely transit-oriented techniques can be adopted. Off-peak fares, discount ride promotions, and similar inducements have worked well in increasing ridership for both transit and paratransit systems. The involvement of business can also be used to promote a system by their granting price discounts to regular system users.

Reduced-fare monthly passes have been proven to encourage system use not only for commuters but also for the general public. In Westport, Connecticut, it was learned that the use of more efficient vehicles led to reduced operating costs. These savings could more than compensate for the costs of discounted monthly and family fares. Such fare inducements led to increased ridership which further enhanced the economic performance of their Maxitaxi and minibus systems.

Summary

Marketing paratransit services begins in the planning phase where an integrated combination of product (service), price, and promotion must be designed. The input of local people and potential service users is a critical element in this process. To succeed, paratransit systems must be used which requires that potential riders know the systems and have confidence in the quality and utility of the services.

# MANAGEMENT OF PARATRANSIT

The purposes of this section are:

- To familiarize students with management tasks associated with paratransit.
- To describe several types of management structures.
- To discuss the concept of brokerage and illustrate its use in paratransit management.

Typically, planners, engineers, managers, and operators have each controlled specific tasks in the overall design and operation of transit systems. By the 1970s, however, the need for coordinated planning and operations became a focal point in the field of urban mass transportation. In the effort to redevelop urban and regional transportation systems, it was discovered that there was a notable lack of expertise in coordinated planning and management.

Just as local characteristics, needs, and conditions determine system designs, they also influence management structures. A city of fifty thousand would obviously have a smaller and less complex organization than a city of

two-hundred thousand. Larger cities or regions may contain several fixed-route systems along with a number of bus, van, and taxi services. Managing these systems as an effective network is the job that confronts today's transportation professionals, and it must be understood that local fiscal and operational environments will determine the size and organization of individual management structures.

General Concepts of Paratransit Management

Coordinators of paratransit systems have generally been people with special interests in a particular area. Since the development of paratransit is relatively new, there are virtually as many management models as there are pilot program experiences. Nevertheless, the need for versatility and self-motivation in managers has been proven in all cases.

The cooperation and participation of the public is the basis for all paratransit operations. Ridesharing and pooling operations require than people make the choice to participate and to remain active. Similarly, the choice to use other paratransit sevices, such as downtown dial-a-ride minibus, often requires that riders actively decide to leave the car at home. In terms of management, this translates into aggressive marketing and good community relations.

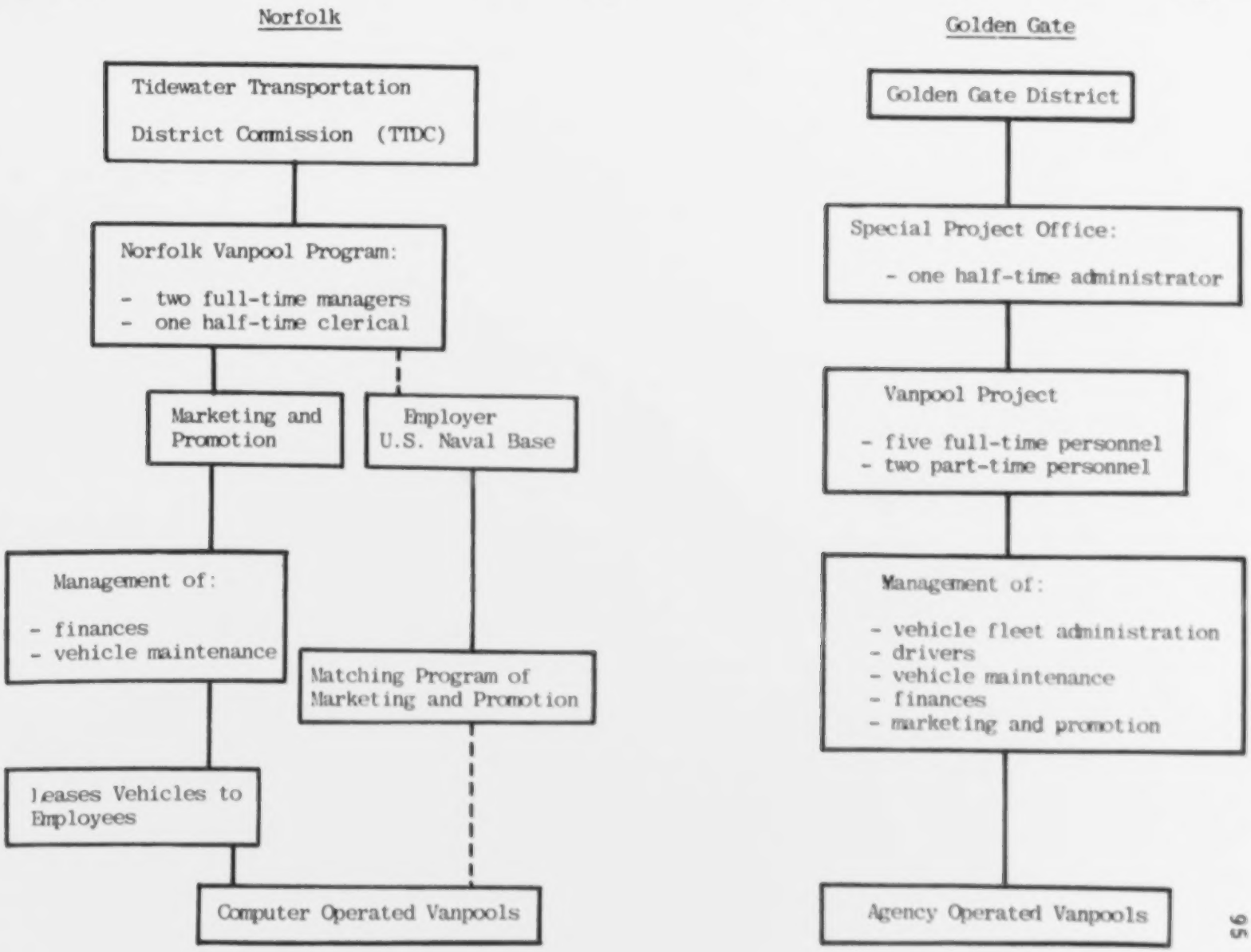
Ongoing evaluation is another key to sound management. This necessitates the monitoring of both quantitative and qualitative elements of the overall system. The mechanisms for evaluation are set in motion during the initial planning stages. The user surveys and computations of performance factors serve as the means of monitoring the systems. A systematic updating of this data should provide the information needed to assess system operations.

Structure

Paratransit operations can be integrated into a mass transit structure or managed as a separate body. In either situation, the management and operations staff will be determined by the size and scope of the operations.

The two examples that follow represent two basic types of paratransit systems, one in which the agency leases vehicles to outside operators, the other in which the agency directly operates vehicles (see Figure 11). These examples, TTDC of Norfolk and Golden Gate were used in the previous section to illustrate financing. The effects of the management structure on the financial needs of an agency can be seen by referring back to the profiles of these two systems. The informatin about these systems is taken from Comparison of Organization and Operational Aspects of Four Vanpool Demonstration Projects (UMTA, 1979).

gure 11. Comparison of Norfolk and Golden Gate Vanpool Systems Structure.






SOURCE: Comparison of Organizational and Operational Aspects of Four Vanpool Demonstration Projects. Heaton, Jacobson, & Poage. 1979.

Norfolk

The Tidewater Transportation District Commission (TTDC) directly manages the Norfolk vanpool program. TTDC purchases vans and leases them to qualified employees of the U.S. Navy. TTDC is also responsible for overall financial management, vehicle maintenance, and general marketing and promotion.

The U.S. Navy supports vanpool projects by conducting matching programs and marketing efforts at the level of the individual commands, which may contain from 20 to 11,000 personnel.

The vanpool program staff at the Tidewater Transportation District Commission is composed of two full-time and one half-time employee:

- Project Manager - responsible for overall implementation and management of the program.
- Transportation Services Representative - responsible for managing the marketing campaigns with the Navy, working with the Navy commands on matching programs, and coordinating with drivers on administrative and operational matters.
- Clerical Person (half-time) - provides clerical support to the program and records monthly operations data from vanpools.

The vanpool staff reports directly to the Service Development Manager who is one of 3 managers reporting to the Executive Director of TTDC. The vanpool program draws upon the resources of other TTDC divisions, such as Finance and Operations, as required.

Golden Gate

The Golden Gate Bridge, Highway and Transportation District directly manages the vanpool program. Its activities include financial management, vehicle maintenance, general marketing and promotion, and matching of pool groups. It also employs professionals in the field to serve on a Technical Advisory Committee.

The vanpool project staff at Golden Gate District is part of the Special Projects Office. The head of this office, the Special Administrator, devotes about half his time to the vanpool project and reports to the District Manager. There are five additional full-time positions and two temporary employees on the staff:

- Vanpool Developer/Project Administrator - responsible for overall administration and project activities for the vanpool program.

- Fleet Administrator/Pool Coordinator - responsible for fleet administration and pool organization. Oversees and assists driver coordinators. Supervises Vanpool Project Assistant and Vanpool Coordinator.

- Vanpool Project Assistant - under direct supervision performs support work in fleet administration, bookkeeping, and data collectin.

  Assistant Pool Coordinator - under general supervision is responsible for matching applicants, qualifying drivers, coordinating organization of pool groups and data collection.

- Vanpool Data Collection Clerk - responsible for maintaining van insurance coverage and billing, organizes and coordinates Defensive Driver Training Courses, and provides clerical support.

- Vanpool Aide (full-time) - responsible for promotion and marketing of the vanpool program.

- Administrative Assistant (part-time) - responsible for the coordination of the various Ridesharing Programs.

Both TTDC and Golden Gate represent commuter vanpool operations only. The structure of a comprehensive multimodal paratransit system will be described and illustrated after the following discussion of transportation brokerage.

Brokerage

Management of paratransit is handled within public or private agencies often by individuals who act as brokers. A brokerage operation is one in which a middleperson (the broker) analyzes demand and negotiates with providers to supply services to specified groups or districts. The broker usually has no capital investment in vehicles and acts as a consultant to organize riders, resolve barriers, set up contracts, and manage financial arrangements in order that service be provided.

Brokerage provides a way to match existing services with designated transportation needs. The brokerage concept seems especially effective because it can provide services outside governmental and political structures. Because of this, brokers are generally free to operate quickly in response to changes.

Some local governments have found it operationally and financially more efficient to broker services or segments of services. The costs of training new personnel along with capital expenses and the maintenance of vehicles can impose increased tax burdens on areas whereas a private operator already has management structures and maintenance facilities in place..

The following is a summary of the Westport Connecticut Integrated Transit System Final Report (UMTA, 1979). It is

intended to demonstrate both the potential scope of paratransit operations as well as the use of brokerage in managing such systems. Figure 12 presents a detailed breakdown of individual operational activities.

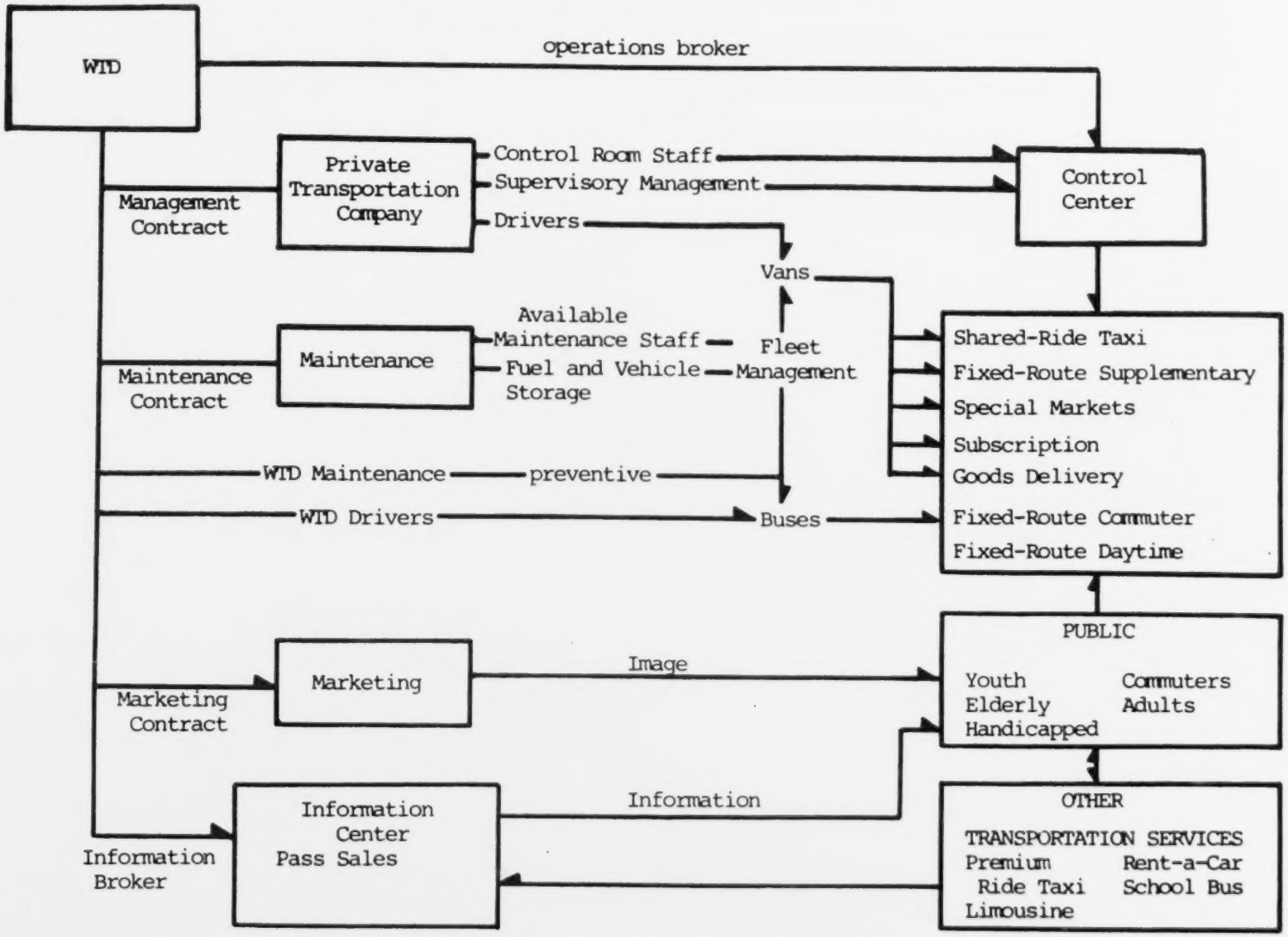
Westport Demonstration Project

The Westport Demonstration was based on a major brokerage role played by the Westport Transit District (WTD) supported by a number of contractual relationships between WTD and the private sector. The major elements of the opertional structure were the management company, the control center, the information center, and system support contracts in the areas of marketing and maintenance (see Figure 12).

This structure enabled the WTD to provide regular and supplemental fixed-route services, shared ride taxi service, and special market services to local residents. The structure also provided a foundation for developing expanded brokerage services to meet the needs of local businesses, downtown merchants, and special groups.

All demonstrations were provided by an integrated vehicle fleet containing the original Minnybus and Coach vehicles, and 11 vans purchased through the Demonstration Grant.

Figure 12. Structure of Westport Demonstration Plan.




SOURCE: Furniss, Robert E., The Westport Connecticut Integrated Transit System, 1979.

101

Management Company

The demonstration involved the WTD inviting the two local taxi operators to form a management company to provide the new paratransit services under contract with the Transit District. The formation of this private entity was an attempt of the WTD to integrate the valuable components of taxi structure and operations which include taxi-type door-to-door service, dispatching capability, administrative experience, and the operations' familiarity with the local community's geography and infrastructure.

The management company's contract responsibilities included provision of personnel, and supervisory and management functions for the folowing system elements:

- Paratransit services including shared-ride taxi, special market services, subscription service, and small-goods delivery.
- Specified supplementary fixed-route services.
- Control center and dispatching duties for the above named services, as well as for all fixed-route services provided directly by the WTD.

Hiring, payroll, and other personnel activities necessary to perform these functions were the sole responsibility of the management contractor.

Control Center

A base of operations was necessary to house the management company and provide an operational nucleus for all communications, dispatching, and fleet deployment activities. Control center space and equipment were provided directly by the WTD, while responsibility for the staffing and supervision was contracted to the management company.

Specific services controlled through the Center included:

- Regular fixed-route bus services, both daytime and commuter (operated by the WTD).
- Supplementary fixed-route services (operated by the WTD and the private contractor).
- Paratransit services including shared-ride taxi, special markets service, subscription service, and small-goods delivery (operated by private contractor).

The Center also planned to handle additional transportation services in the community (rent-a-car, limousine, premium ride taxi) in the event the WTD was successful in integrating other services through its brokerage role.

Information Center

The next system element was an interface between the service operations and the public. The Center's function was to provide comprehensive information on all transit and paratransit services in Westport as well as premium-ride taxi, regional bus service, commuter rail services, and rent-a-car service.

Support System Contracts

Marketing and maintenance activities were carried out through contractual arrangements with outside professionals. The markeing program provided by the contracted firm stressed the comprehensiveness of the Westport system and the integrated nature of the services. The program included direct mailings, radio and television advertising, and information displays.

The maintenance contract covered the general management of the vehicles, fuel and vehicle storage, and vehicle repairs. The contract was with a local school bus contractor whose garage was conveniently located near downtown Westport. Since this facility already had the personnel and equipment to handle maintenance operations, the costs to WTD were significantly lower than they would have been if personnel were hired and equipment and facilities purchased or leased.

Summary

The evolving role of a transportation manager is one which included community contact and coordination along with technical and engineering expertise. Because characteristics and needs are unique to individual locales, management structures must be flexibile. Transportation brokerage is a developing enterprise which offers new opportunities to both regional systems and individuals.

## OVERALL SUMMARY OF PARATRANSIT MODULE

Paratransit is an approach to transportation which utilizes vehicles on a continuum between the solo-driven private automobile and fixed-route bus and rail systems. It is a modern concept (though ideas such as ridesharing are as old as transportation itself) which is aimed at low-cost needs-based systems. Paratransit operations focus on utilizing existing resources in innovative ways that address specific needs and preferences of specified user segments.

Paratransit systems can use a variety of modes and vehicle types in providing services. Such systems are often demand-responsive in that direct door-to-door transportation is available to riders. This type of service is especially effective for elderly and hanidcapped users. The utilization of private taxi and van services has helped sponsors virtually eliminate the capital costs and reduce the operating costs of demand-responsive systems.

A second major area of paratransit focus has been in coordinating ridesharing and pooling services. Much of this effort involves identifying and working with large employers since the workplace offers easy access to large numbers of users. Lastly, paratransit has been used to

provide feeder lines for fixed-route bus and rail systems.

The planning process for paratransit systems can be broken down into four steps: 1) market segmentation analysis; 2) assessment of existing services; 3) analysis of unmet needs, and 4) targeted design. This process identified market segments according to user needs and characteristics, then breaks down the segments into subgroups called clusters. Existing services are evaluated to determine whether unserved needs can be met by such services or whether new sytems are required.

New systems are designed according to the specific sizes and needs of targeted unserved groups. Implementing new systems can be a difficult task for planners, however, as local political and financial considerations often take procedure over the best recommendations of transportation planners. It is for this reason, that the involvment of local people and community leaders in the planning process is so critical.

Financial and management structures of paratransit systems are determined within the context of the size and scope of proposed operations. Management and operational costs will depend on the size of the agency staff and whether the purchase and operation of vehicles are required. Management structure will also depend on whether operations will be handled within or outside the mass transit agency.

Marketing is a principal tool for establishing and maintaining ridership for systems. A strategy for marketing should begin during the planning stages by involving local people and community groups in the needs assessment. Participation by the public is essential to the success of paratransit operations.

Paratransit represents a new option for transportation planners. Since the beginning of demonstration projects in 1974 under the Office of Service and Methods Demonstration (SMD), a subdivision of the Urban Mass Transit Administration (UMTA), a number of attempts have been made to increase mobility and reduce auto traffic congestion through the use of cost-effective and easily implemented systems. The results of these demonstration projects are available from UMTA (see Biblography, Appendix A). In this module an attempt was made to consolidate the major concepts and conclusions derived from the project reports. The information in this module the first steps in the evolution of modern paratransit in America.

## STUDENT REVIEW AND INVESTIGATIONS

1. Why might a private corporation be persuaded to purchase a fleet of vans for a ridersharing program for its employees, and how could these costs be recovered by the corporation.

2. a. What are user-side subsidies?
   b. Discuss the use of these subsidies and the effects (positive and negative) that they might have on a region's transit network.

3. Describe the brokerage function and its applications to paratransit management.

4. How can initial planning activities be used as a marketing strategy for paratransit systems, and why might this be an effective technique?

5. How can the information gained from assessing existing systems be used to help in marketing them?

6. Interview someone who utilizes a carpool or vanpool. Discuss the costs and benefits of the arrangement and how the group handles the radio, smoking, unscheduled stops, and lateness. Report to the class and discuss.

GUIDELINES FOR STUDENT REVIEW

1. The amount of necessary parking space is significantly reduced, leaving more land for productive use, and studies have shown that employees arrive at work on time more regularly. Costs can be recovered through tax deductions for depreciation and investments in parking lot construction and maintenance; and through greater productivity due to more regular starting and finishing times of employees.

2. a. User side subsidies consist of discounted ride tickets used most commonly by special needs groups such as the elderly and the handicapped.

   b. Common reasons given include:

   Positive: More people use public and commercial carriers, special needs groups become more mobile; more money moves through transit systems. Private operators can also prosper while helping meet public needs cost-effectively.

   Negative: Political posturing stemming from debates over who gets the subsidies; objections by carriers who do not benefit; debate over how to finance.

3. See page 90.

4. Initial market segmentation analysis reveals what services are desired and what system characterics are foremost in people's decisions to choose a particular system. This also aids in the planning of system promotion.

5. It can provide the economic and environmental data, cost per passenger mile, fuel consumption, air quality, and other factors that demonstrate the utility of public systems over private auto use. It can also identify systems or time periods of system operations which can benefit from fare changes.

## SELECTED REFERENCES FOR PARATRANSIT

These sources were particularly useful in the preparation of this module. A complete bibliography follows.

Abkowitz, 1982

Bowan, et al, 1977

Charles River Associates, 1980

Cohen, et al, 1978

Cook, 1979

Cook, & Barb, 1979

Demetsky, et al, 1982

Fleishman, & Flusberg, 1982

Fleishman, & Flusberg, 1982

Furniss, 1979

Heaton, et al, 1970

Holoszyc, & Newman, 1980

Kirby, et al, 1974

Kocur, & Louviere, 1979

Lee, et al, 1981

Multisystems, Inc., April 1982

Multisystems, Inc., January 1982

Multisystems, Inc., 1978

Smerk, et al, 1980

Sobel, & Alschuler, 1980

Teal, 1982

Technology Sharing, 1981

Tennessee Valley Authority, 1980

Transportation Research Board, TRR 863, 1982

Transportation Systems Center (DOT), 1981

UMTA/DOT. Paratransit Services for the Transportation Handicapped, April 1982

Valente, 1983

Ward, et al, 1977

# APPENDIX A: BIBLIOGRAPHY

Abbreviations to be used in this bibliography:

| | |
|---|---|
| DOT | Department of Transportation |
| FHA | Federal Highway Administration |
| NTIS | National Technical Information Service |
| OSMD | Office of Service and Method Demonstrations |
| TRB | Transportation Research Board |
| TRR | Transportation Research Record |
| TSC | Transportation System Center |
| UMTA | Urban Mass Transportation Administration |

Abkowitz, M., Damm, D., Heaton, C., & Jacobson, J. (1982). Impacts and effectiveness of third party vanpooling. Washington, DC: UMTA/TSC.

APTA (1985). Transit fact book 1985. Washington, DC: American Public Transit Association.

Barb, C.E., & Cook, A.R. (1979). Technology transfer in paratransit: Five case studies. Washington, DC: National Academy of Sciences.

Barber, E.J., Wagner, D.W., Ellis, R.H., & Hallenbeck, M.E. (1982). The Newport News, Virginia, easy-ride transportation brokerage demonstration project. Washington, DC: DOT/UMTA.

Bautz, James A. Urban Microscale Planning for the 1980s. Paper Prepared for the Conference on Travel Analysis Methods for the 1980's, Easton, MD, Oct.. 3-7, 1982.

Beeson, J.D. (1978). Knoxville commuter pool: Annual report, 1977-78. Washington, DC: DOT/UMTA.

Boaz, M., & Harman, L.J. (1980). The human services transportation consortium of Greater Bridgeport. Bridgeport, CT: Human Services Transportation Consortium.

Borowski, R.H. (1979). Automobile diversion: A strategy for reducing traffic in sensitive areas. Washington, DC: National Academy of Science.

Burkhardt, C.E., Burker, W.G., Eisenberg, M.A., et al. Coordination and consolidation of agency transportation. Washington, DC: TRB.

Casey, R.F. (1981). The accessible fixed-route service experience. Washington, DC: UMTA/OSMD.

Cervero, R. Experiences with Time of Day Transit Pricing. Washington, DC: TRB.

Charles River Associates, Inc. (1984). ACCESS: Brokering Paratransit services to the elderly and handicapped in Allegheny County, PA. Washington, DC: Office of Management Research and Transit Services, UMTA.

Charles River Associates for Transportation Systems Center for UMTA, DOT. (1980). Innovation techniques and methods in the management and operation of public transportation services. Washington, DC: DOT/UMTA.

Cohen, H.S., Stowers, J.R., & Petersitia, M.P. (1978). Evaluating urban transportation system alternatives. Springfield: NTIS.

Conner, D.L. (1979). Findings of preliminary analysis of the Trenton, New Jersey off-peak, fare-free transit demonstrations. Washigton, DC: UMTA.

Cook, A.R. (1979). Paratransit resource guide. Washington, DC: DOT/UMTA/University Research & Training Division.

Cook, A.R., & Barb, C.E. (1980). Paratransit curriculum guide. Washington, DC: DOT/UMTA.

Cook, A.R., Barb, C.E., & University of Oklahoma. (1979). Paratransit case studies: Overview. Washington, DC: DOT/UMTA/University Research and Training Division.

Dare, C.E. (1981). Transportation energy contingency plans for rural areas and small communities. Washington, DC: DOT.

Davis, F.W., Beeson, J.D., & Wegmann, F.J. (1978). The Knoxville transportation brokerage project:Philosophy and institutional issues. Final Report. Knoxville.

Davis, Groff, & Steahr. (June 1981). The analysis of the potential for dynamic ridesharing in a low density area. Executive Summary. Connecticut: Connecticut Transportation Institute.

Demetsky, M.J., Hoel, L.A., et al. (May 1982). Decision procedures for paratrnsit market selection and service evaluation. Washington, DC: DOT/UMTA/University Research Divison.

Demetsky, M.J., & Lantz, K.E. (1980). Implementation planning of integrated trnsit services for a small urban and rural area. Washington, DC: DOT/UMTA/University Research and Training Division.

Dorosin, E., & Phillips, J. (1979). Share a fare: A user-side subsidy transportation program for elderly and handicapped persons in Kansas City, Missouri. Washington, DC; DOT/UMTA.

Ecosometrics, Inc. The sixth national conference on rural public transportation. Final report, Nov. 1983, No. DOT-I-83-52.

Ecoplan International and Multisystems, Inc. (1982). The European paratransit experience. Paratransit: Options for the Future. Washington, DC: DOT/UMTA/Office of Policy Research.

Fleishman, D. (no date). Mercer County, New Jersey, coordination/consolidation demonstration project. Washington, DC: UMTA/TSC.

Fleishman, D., & Flusberg, M. (1982). Paratransit for the work trip: Commuter ridesharing. Paratransit: Options for the Future. Washington, DC: DOT/UMTA/Office of Policy Research.

Fleishman, D., & Flusberg, M. (1982). Paratransit in rural areas: Paratransit: Options for the Future. Washington, DC: DOT/UMTA/Office of Policy Research.

Furniss, R.E. (1979). The Westport Connecticut integrated transit system. Washington, DC: DOT/UMTA.

Green, D., & Assoc., Inc. Use of volunteers in the transportation of elderly and handicapped persons. Final report, Jan. 1984, No. DOT-I-84-02.

Heaton, C., Abkowitz, M., Domm, D., & Jacobson, J. (March 1983). Impacts and effectivness of third party vanpooling: A snthesis and comarison of findings for four demonstration projects. Washington, DC: DOT/UMTA.

Heaton, C., Jacobson, J., & Poage. (April 1979). Comparison of organizational and operational aaspects of four vanpool demonstration projects. Cambridge, MA: DOT/Research and Special Programs Administration.

Hoel, L., Perle, E., Kansky, K., et al. (no date). Latent demand for urban transportation. Pittsburgh, PA: Transportation Research Institute of Carnegie-Mellon University.

Holoszyc, M. & Beach, B. F. Transit Fare Prepayment Innovations in Sacramento. Washington, DC: TRB.

Holoszyc, M., & Newman, D. (1980). Evaluation of the Rochester, New York community transit service demonstration. Executive Summary (Vol. I). Washington, DC: UMTA/TSC.

Homitz, Allen & Associates. (1981). Training course for personnel in areawide ridesharing agencies. Washington, DC: DOT/Federal Highway Administration.

Hood, T.C., & Geiss, L.S. (April 1982). The volunteer tranpsortation program:Some suggestions and cautions in the use of volunteers as drivers, escorts, and other transportation workers. Washington, DC: DOT.

Iskander, W.H., & Hage, N.M. (December 1981). Integration of AGT systems with other transportation modes. Final Report. Washington, DC: DOT/UMTA.

Kirby, Bhatt, Kemp, et al. (1974). Paratransit: Neglected options for urban mobility. Washington, DC: DOT/Urban Institute.

Kocur, G., & Louviere, J. (1979). An analysis of user cost and service trade-offs in transit and paratransit services. Washington, DC: UMTA/TSC.

Lave, R.E., & Holoszyc, M.A. (March 1979). The Rochester New York integrated transit demonstration. Executive Summary (Vol. I). Washington, DC: DOT/UMTA.

Lee, Tamahlow, & Mulinazzi. (April 1981). A public transportation needs study for low density areas in a five state region in the Midwest. Washington, DC: UMTA/Office ofPublic Research/University of Kansas.

Meyburg, A.H. (October 1975). Mass transit development for small urban areas: A case study - Tompkins County New York. Second Year Final Report. Washington, DC: DOT.

Misch, Margolin, Curry, et al. (December 1981). Guidelines for using vanpools and carpools as a TSM technique (National Cooperative Highway Research Program Report #241). Washington, DC: TRB.

Multisystems, Inc. (1984). Estimating Patronage for Community Transit Services. Washington, DC: Technology Sharing Program, UMTA-USDOT.

Multisystems, Inc. (January 1982). Paratransit for the work trip: Commuter ridesharing. Washington, DC: DOT/UMTA.

Multisystems, Inc. (August 1978). Taxis, the public and paratransit: A coordination primer. Cambridge, MA: Multisystems, Inc.

Nelson, D., Spano, M., & Skepetin, S. (1981). Fixed route accessible bus service in Connecticut: A case study. Washington, DC:DOT/UMTA.

Newman, D.A., Bebendorf, M. (1983). Integrated bicycles and transit in Santa Barbara, California. Washington, DC: DOT/UMTA.

Newman, D.A., Holoszyc, M. Evaluation of the Rochester, New York community transit service demonstration. Executive Summary (Vol. I). Washington, DC: DOT/UMTA.

Office of Assistant Secretary for Government and Public Affairs. (May 1979). How ridesharing can help your company. Washington, DC: DOT/Assistant Secretary for Government and Public Affairs.

Public Technology, Inc. (June 1979). Transit pricing techniques to improve productivity. Washington, DC: DOT/UMTA/OSMD.

Public Technology, Inc. (January 1980). Institutinal framework for integrated transportation planning. Washington, DC: DOT/UMTA/Urban Consortium for Technology Initiatives.

Public Technology, Inc. (January 1980). Neighborhood controls. Washington, DC: DOT/Urban Consortium for Technology Initatives.

Public Technology, Inc. (April 1980). Center city environment and transportation innovations in five European cities. Washington, DC: DOT/UMTA/Department of Housing and Urban Development.

Public Technology, Inc. (September 1980). Taxicabs as public transit. Washington, DC: DOT/Consortium for Technology Initiatives.

Rural America (July/Aug. 1983). Getting There: Making Rural Transportation Work.

Schmidtt, R., Weitman, J., Beimborn, E. (April 1982). Examination of methods for cordinatin of transportation planning activities. Washington, DC: DOT/UMTA.

Schneider, J.B. (September 1981). Transit and the polycentric city. Washington, DC: DOT/UMTA/University Research and Training Program.

School of Urban Sciences, University of Illinois at Chicago Circle. (January 1981). Moving people. Chicago: University of Illinois.

Smerk, G.M., & Gerty, R.B. (1980). Mass transit management: A handbook for small cities (2nd ed.) (Parts I, II, III, IV). Washington, DC: DOT/UMTA.

Sobel, K.L., Alschuler, D.M. (1980). Paratransit planning: Application of a systematic market-oriented planning and programming process (Transportation Research Record #778). Washington, DC: TRB/National Research Council.

Soot, S., Stenson, H., Esser, M., & Joyce, L. (1982). Cognitive aspects of transit use in areas of high and low travel density. Executive Summary. Washington, DC: DOT/UMTA.

Spear, B.D., et al. (December 1981). Service and methods demonstrations program report. Washington, DC: UMTA.

Stammer, Robert E. & Giangrande, R.V. Microcomputer operation: The Tennessee experience.

Stommes, Eileen S. (1985) The use of cooperatives for alternative rural passenger transportation: Report on a New York study. TRB Paper.

Studenmund, A.H. (1982). The appropriate measures of productivity and output for the evaluation of transit demonstration projects. Washington, DC: DOT/UMTA.

Suhribier, J.H., & Wagner, F.A. (April 1979). Vanpool research: State of the art review. Washington, DC: DOT/UMTA.

Teal, R.F., Goodhue, R.E., Rooney, S.B., & Mortazavi, K. (1982). Taxi-based public transportaion for the elderly and the handicapped (Transportation Research Record #863). Washington, DC:TRB.

Technology Sharing. (March 1981). Paratrnsit: State of the art review. Washington, DC: DOT.

Tennessee Valley Authority. (March 1980). Ridesharing vs. road building: The TVA experience. Washington, DC: DOT/UMTA.

Texas Transportation Institute, Texas A & M University. (January 1978). Instructors manual: Aleternatives for improving urban transportation - a management overview. Washington, DC: DOT.

Transportation Center of the University of Tennessee. Transportation brokerage for executive Management. Washington, DC: UMTA.

TRB. (1980). New directions in transportation education (Transportation Research Record #748). Washington, DC: National Academy of Sciences.

TRB. (1981). Ridesharing needs and requirements: The role of the private and public sectors. Washington, DC: DOT/UMTA.

TRB. (1981). Transportation education and training: Meeting the needs of the 1980s (Transportation Research Record #793). Washington, DC: National Academy of Sciences.

TRB. (1982). Paratransit planning and management (Tranportation Research Record #863). Washington, DC: National Academy of Sciences.

TRB. (1982). Ridesharing 1981. Washington, DC: National Academy of Sciences.

TSC. (March 1981). Paratransit: State of the art overview. Washington, DC: DOT/TSC.

TSC & UMTA. (1974). State of the art overview of demand-responsive transportation. Washington, DC: DOT/UMTA.

UMTA (Aug. 1984). A Manual for Planning and Implementing a Fare Change. Washington, DC: UMTA.

UMTA/DOT. (1980). Innovative techniques and methods in the management and operation of public transportation services. Washington, DC: DOT/UMTA.

UMTA/DOT. (September 1980). Rural transportation projects on Indian reservations: A report on eleven demonstrations. Washington, DC: DOT/UMTA.

UMTA/DOT. (April 1982). Paratransit services for the transportation handicapped. Washington, DC: DOT/UMTA.

UMTA/DOT/FHWA. (March 1981). Rural and small urban transit manager s workshop: Student workbook, Vols. 1 & 2, .

University of Oklahoma, School of Civil Engineering and Environmental Science. Paratransit resource guide. Washington, DC: DOT/Technology Sharing Program.

Urban Mass Transportation Administration Unviersity Research Conference. (1980). The future market for public transportation peak period transit services: Strategies for the 1980s (Panel sessions of the Urban Mass Transportation Administration University Research Conference). Washington, DC: DOT/UMTA.

Urban Mass Transportation Research Informtion Service. (August 1982). Urban transportation abstracts. (Vol. I, Part 1). Washington, DC: UMTA.

Valente, P. (International City Management Association). (1983). Public transportation training package. Wahington, DC: DOT/UMTA.

Wegman, Bell, et al. (November 1978). The Knoxville transportation brokerage project (Vol. III: An Eighteen Month Evaluation). Washington, DC: DOT/UMTA.

Weisbrod, G.E., & Eder, E.S. (Cambridge Systematics, Inc.) (June 1980). Evaluation of the Minneapolis ridesharing commuter services demonstration. Washington, DC: DOT/UMTA/OSMD.

Young, D. (March 1983). Transit in transition: Major changes ahead. Mass Transit, p. 4.

Yukubousky, R. & Fitcher, D. Mobility club: A grass-roots rural and small town transport concept. NY DOT, PRR 69, Aug. 1974.